移动终端自动化测试

第三十三期软件测试沙龙

（北京站）

2008 Excellence Awards

The Mobile & Embedded Systems Experts

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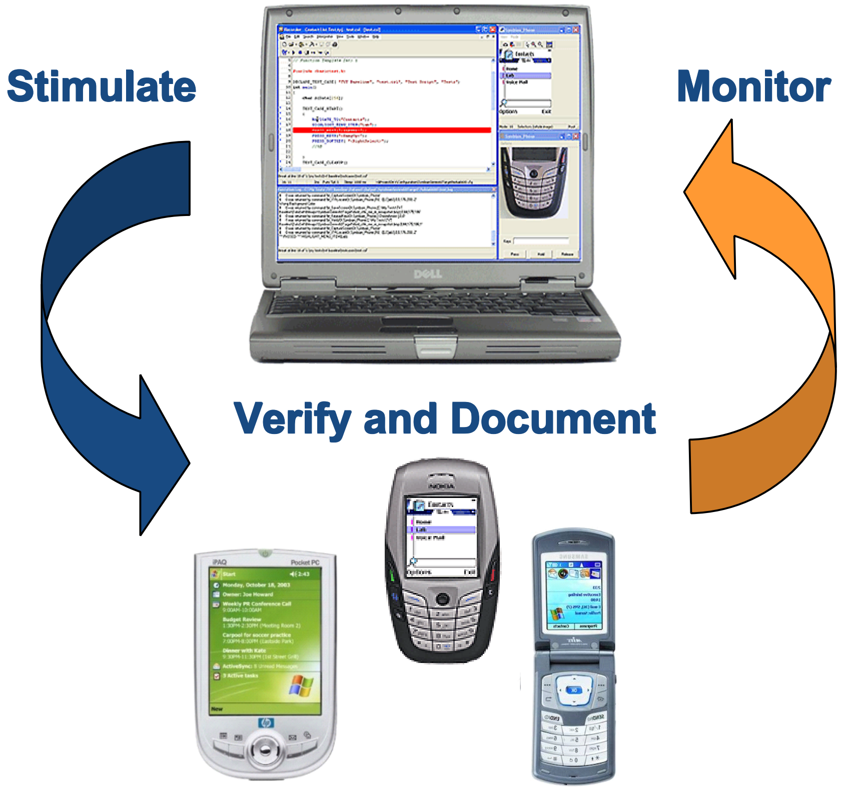
Agenda (Apr 25, 2009)

- An MMI Based Test Automation Solution for Mobile and Wireless
- Connectivity Solutions b/w PC and Mobile Device
- OCR (Optical Character Recognition) Technology and Automatic Verification
- TestCase Design & Debug IDE: Scripts -> Full GUI
- TestCase Reuse/Porting: Adaptive Technology
- TestCase Management and Sharing
- A Proven Quality Assurance Methodology
- Q&A
- TestQuest CountDown Demo

MMI Based Test Automation Solution

- The host software functions like a Virtual User
  - Stimulations: Keys, Touchscreen
  - Monitor: Screen objects/images

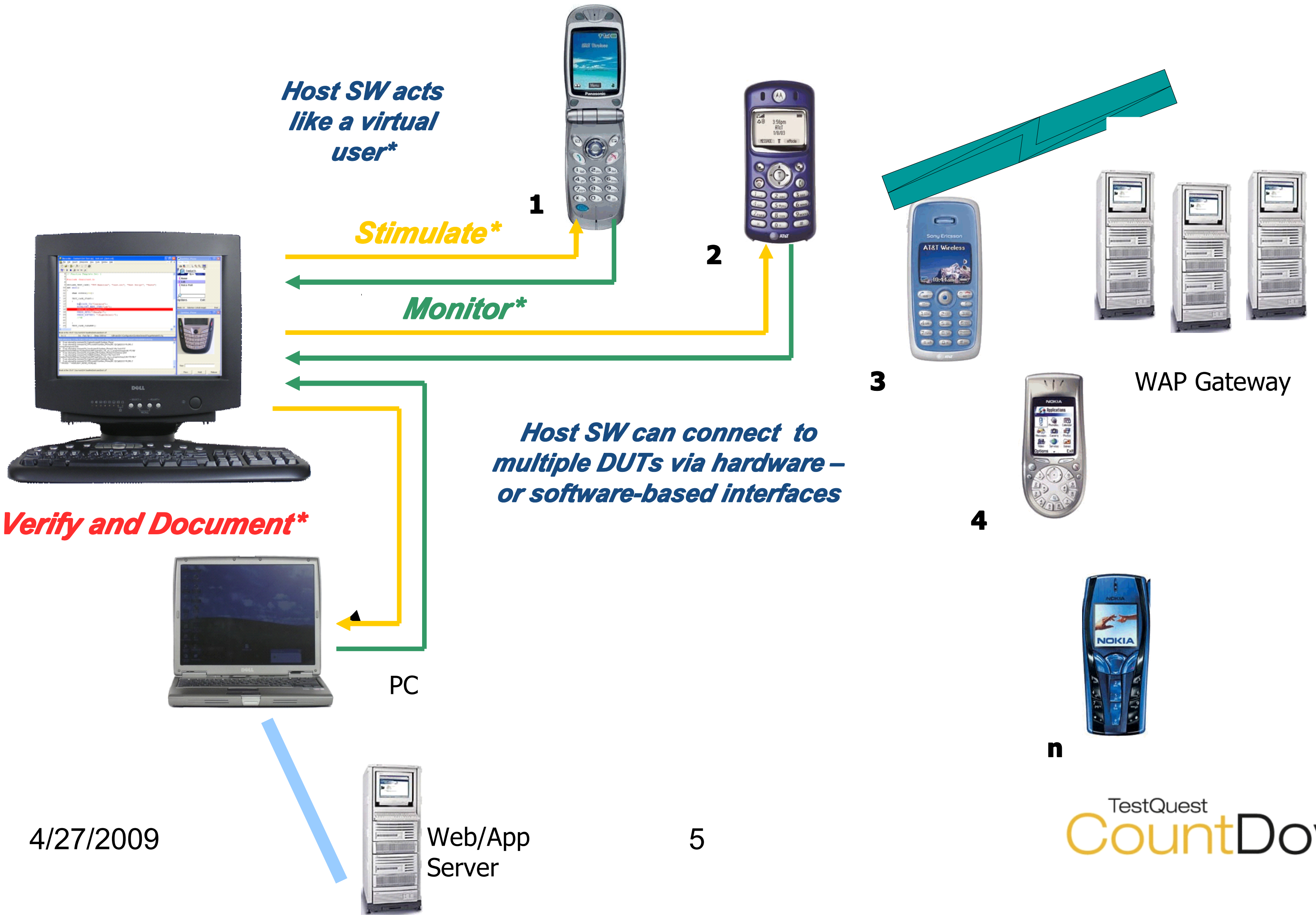


Benefits:

- OS Independent
- Platform Independent
- Multi-Target
- Non-Intrusive

MMI Based Test Automation Solution

- Test Configuration Example


Host SW acts like a virtual user*
Stimulate*
Monitor*
1
2
3
4
n
WAP Gateway
Host SW can connect to multiple DUTs via hardware – or software-based interfaces
Verify and Document*
PC
Web/App Server

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MMI Based Test Automation Solution – cont.

- MMI based Test Automation is mostly for **Black Box** testing
- To substitute Manual Testing where requires repeat operations
- Used for Functional Testing, Regression Testing, Performance Testing and Stress Testing
- Cooperate with HW Equipments or User Defined SW Components for Integration Test
- Universal Test Automation Solution to Any Device with Keypad/Touchscreen Input and a Display - Phones, PNDs, Medical Devices, etc

For Product Quality Improvement!!!

Connectivity Solution

- Connect and then Test
- Connectivity b/w Host PC and DUT enables the bidirectional control – Stimulation and Monitoring

- Two Approaches – Software Approach, Hardware Approach

Connectivity Solution

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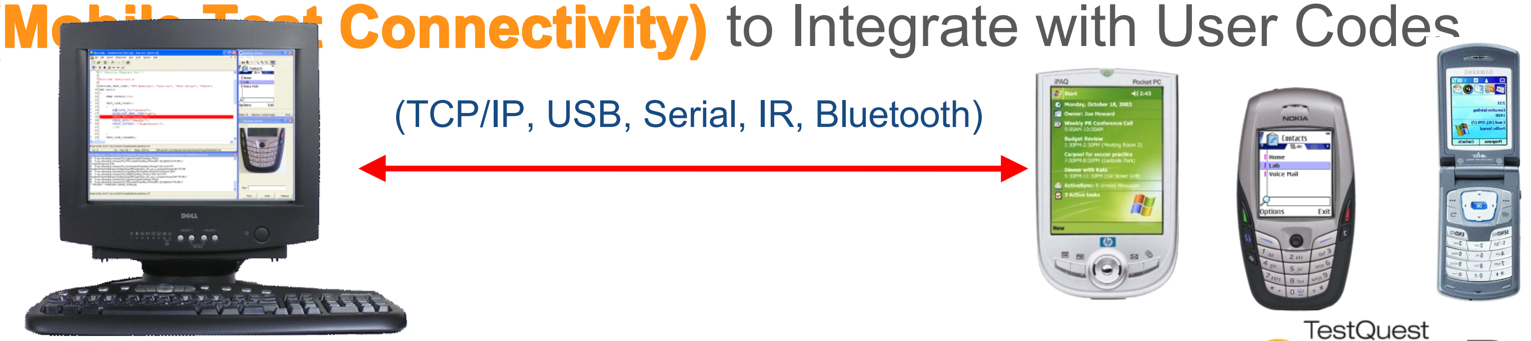
Connectivity Solution – SW Approach

- Small ‘Agent’ Application installed on DUT, Running Background
- Interface with Host PC via Native Interface
- Very Small Footprint on DUT (non-intrusive)
- The Agent Brokers Commands from Host PC – Keys, Touchpad, Screen, etc. (Host PC -> Client / Agent on DUT -> Server)
- Support for all Open Mobile OSs: **Off-the-shelf Agent** for Win Mobile, WinCE, Win Desktop, Symbian S60, Symbian UIQ, Palm, Brew, BlackBerry, Linux, Android…
- Support for all Closed or Proprietary Feature Phone OSs: **MTC (Mobile Test Connectivity)** to Integrate with User Codes



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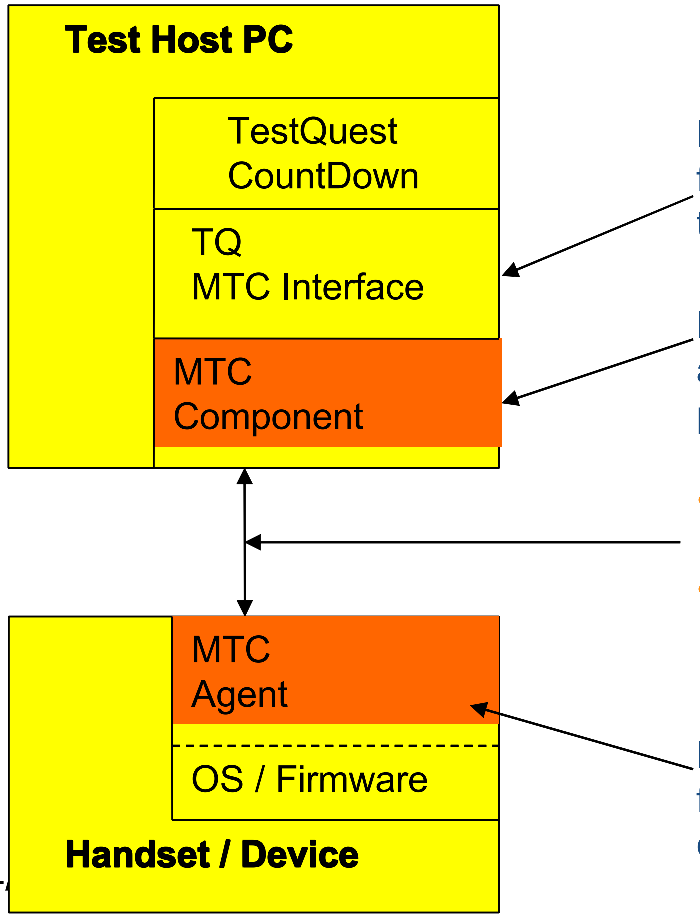
MTC Architecture

- **MTC** Requires Custom Implementation of
  - MTC Component: COM (.DLL) on the Host PC
  - MTC Agent: Software Agent on DUT



Handset interface (receives requests from TQ host and issues command to handset)

Interprets requests and commands and implements communication protocol

- **Physical Connection (USB, RS-232, Bluetooth, etc.)**
- **Transport Protocol (TCP/IP, Raw Serial, RFCOMM, etc.)**

Interprets and processes requests from TQ host and implements communication protocol

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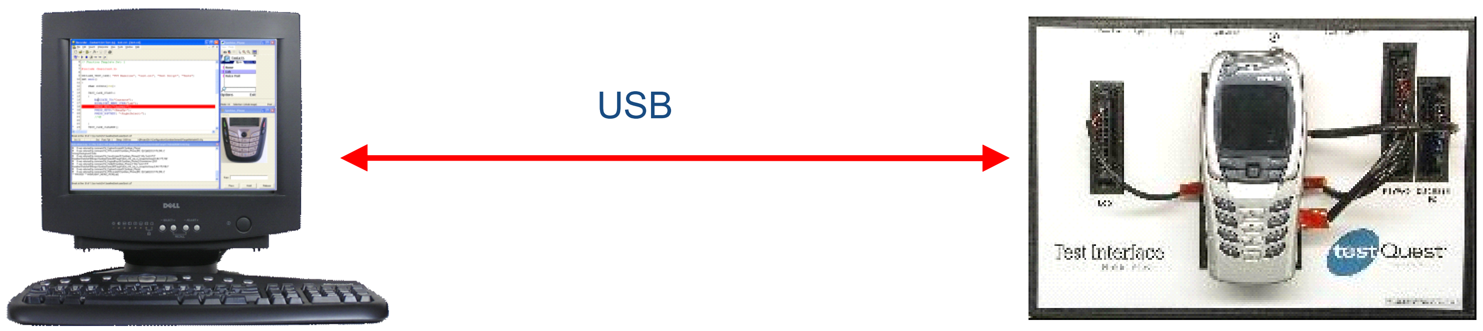
Connectivity Solution – HW Approach

- Physical Hardwire Connections to Human Interfaces (Screen, Buttons, etc)
- Zero Software Installed on DUT
- Support for Any Device/OS
- Advanced Functionality: Supports Power On/Power Off, Battery Level, Battery Pull Simulation, Flip, Discrete Components Monitoring (LEDs, Vibrator, Audio, Video, etc)



SW Approach V.S. HW Approach

Typical Testing Scenarios:

1. Telephony
2. SMS/MMS
3. Contacts
4. Email
5. Browser
6. Alarm Clock
7. Camera Functionality
8. Audio/Video Player Functionality
9. Bluetooth/Wifi Intf
10. Mobile Widget

……

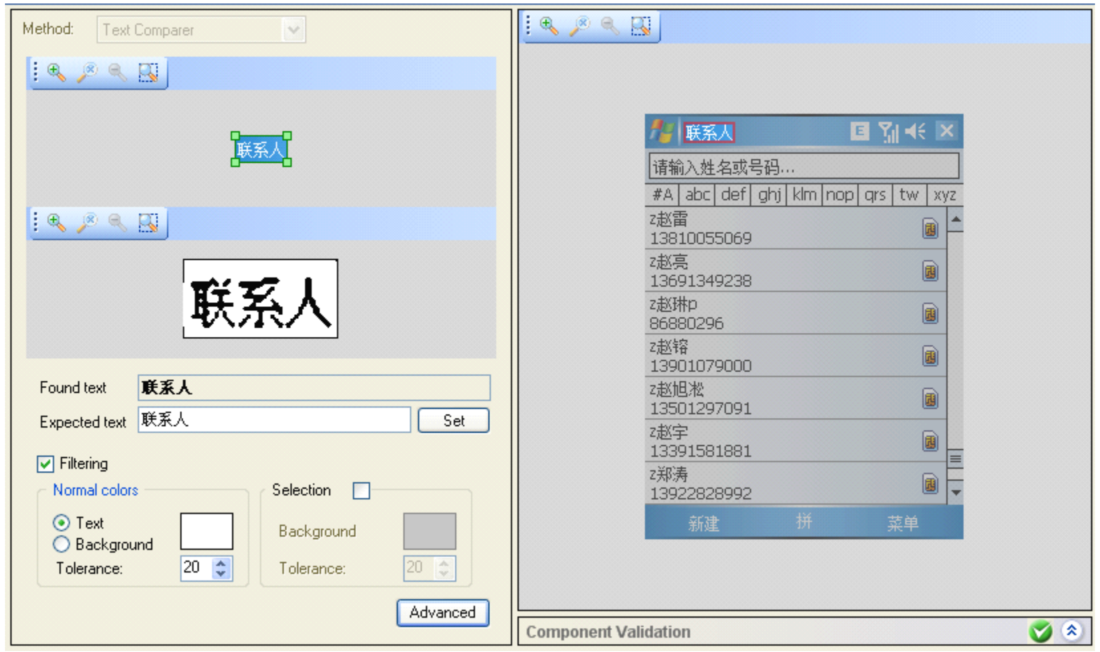
Hardware Connectivity Only:

11. Power On/Power Off
12. Battery Level
13. Battery Pull Simulation
14. Flip Operation Simulation
15. Discrete Components (LED, Vibrator, etc)
16. General I/O to test Registers
17. Audio/Video Quality

……

OCR for Automatic Verification

- OCR (Optical Character Recognition) Technology to Mimic Human Eyes to Automatically Verify the Screen Results
- Two Approaches to Verify the Screen Results on Host PC:
  - To compare Icons: compare pixel by pixel
  - To compare Texts: apply OCR over image to get Text result and then compare



Method: Text Comparer

Found text: 联系人

Expected text: 联系人

☑ Filtering

Normal colors: [✓ Text] Background

Tolerance: 20

Selection ☐

Background

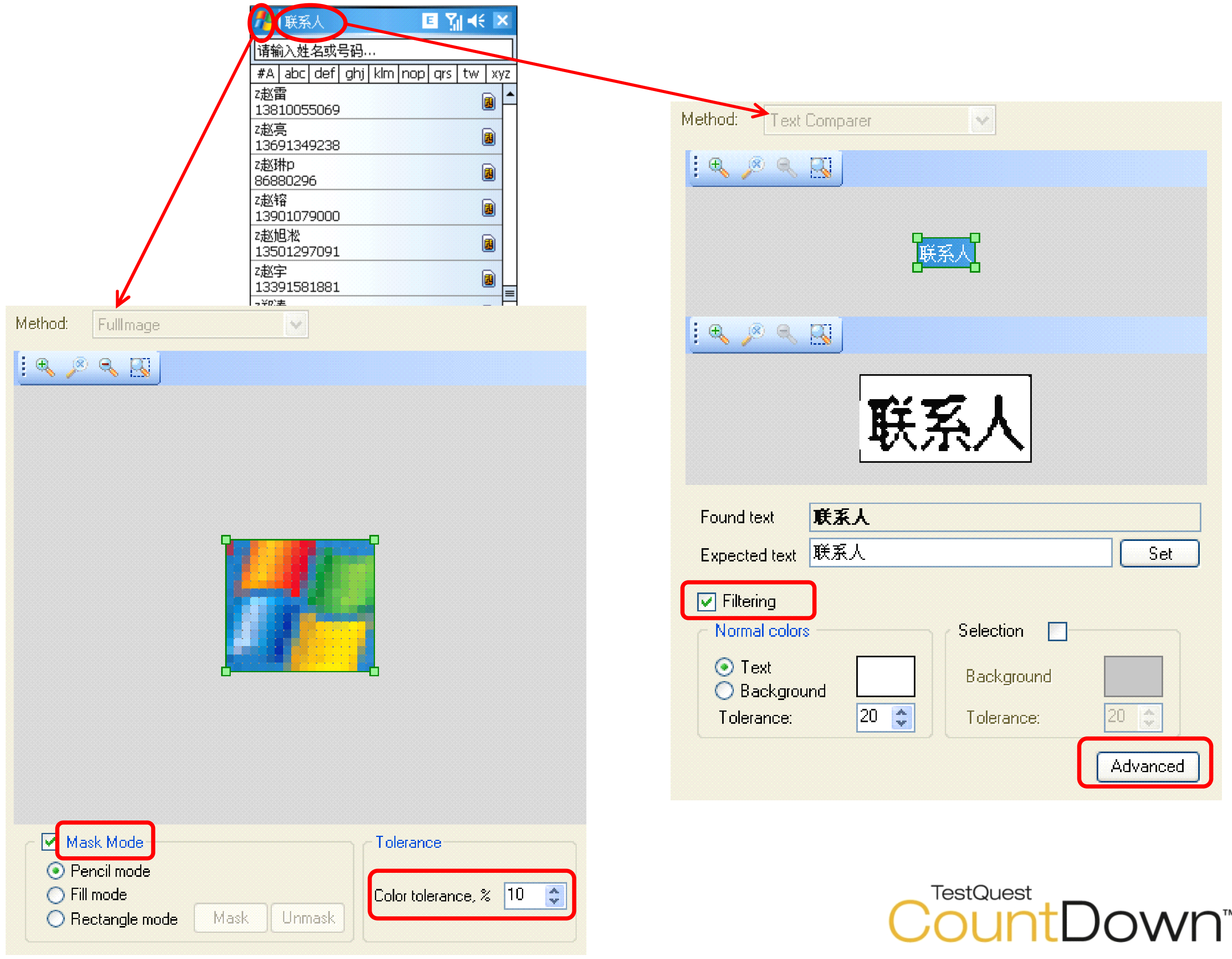
Tolerance: 20

Component Validation

Compare Smart – Intelligent Controls

- UI Components: Icon, Label, TextField, Button, Menu, tec
- Intelligent Controls to Recognize the UI Compoments
- Control Recognition Rules:
  - Color Tolerance
  - Color Filtering
  - Color Masking
  - Positioning
  - Advanced Rules
- Control Properties:
  - Constrain Location/Area
  - Parent
  - Anchor

Intelligent Controls: Icon and Label



联系人

请输入姓名或号码...

#A | abc | def | ghj | klm | nop | qrs | tw | xyz

z赵雷 13810055069
z赵亮 13691349238
z赵翀p 86880296
z赵锫 13901079000
z赵旭凇 13501297091
z赵宇 13391581881

Method: FullImage

[✓] Mask Mode
[● Pencil mode]
○ Fill mode
○ Rectangle mode
Mask Unmask

Tolerance
Color tolerance, % 10

Method: Text Comparer

Found text: 联系人
Expected text: 联系人 Set

[✓] Filtering

Normal colors
[● Text]
○ Background
Tolerance: 20

Selection [ ]
Background
Tolerance: 20

Advanced

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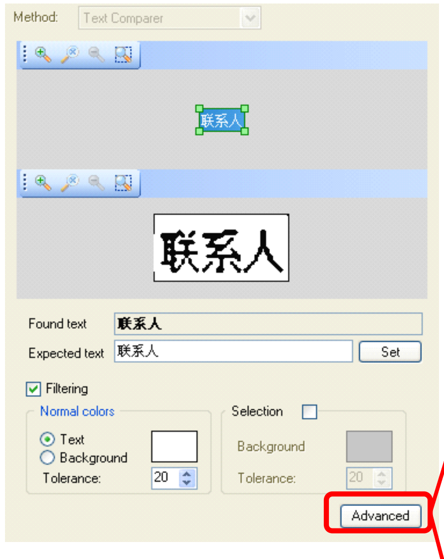
Label: Advanced Text Recognition



Method: Text Comparer

Found text: 联系人

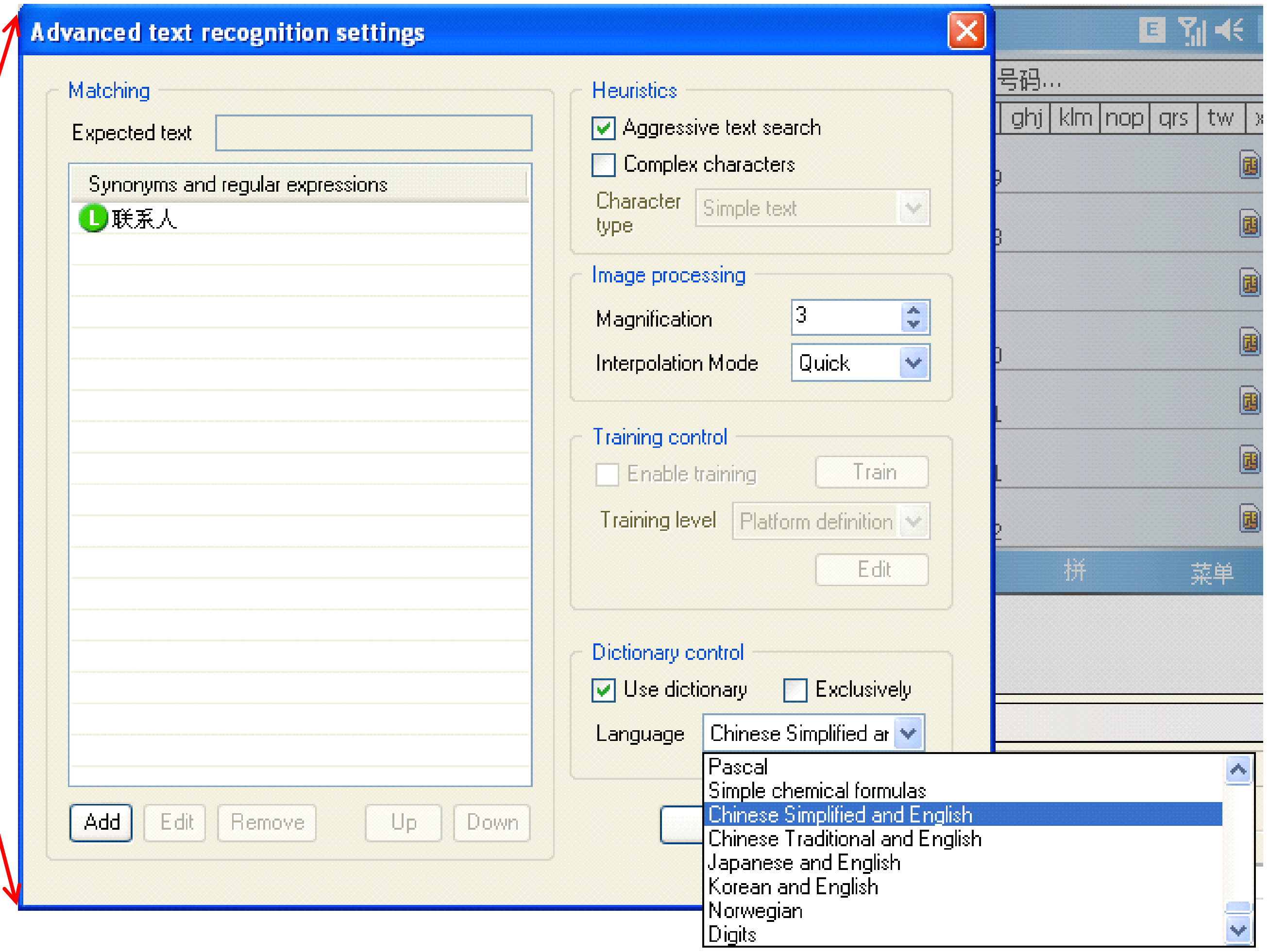
Expected text: 联系人 [Set]

[✓] Filtering

Normal colors
- (●) Text
- ( ) Background
- Tolerance: 20

Selection [ ]
- Background
- Tolerance: 20

[Advanced]



Advanced text recognition settings

Matching
- Expected text:
- Synonyms and regular expressions: 联系人
- [Add] [Edit] [Remove] [Up] [Down]

Heuristics
- [✓] Aggressive text search
- [ ] Complex characters
- Character type: Simple text

Image processing
- Magnification: 3
- Interpolation Mode: Quick

Training control
- [ ] Enable training [Train]
- Training level: Platform definition
- [Edit]

Dictionary control
- [✓] Use dictionary [ ] Exclusively
- Language: Chinese Simplified ar

Pascal
Simple chemical formulas
Chinese Simplified and English
Chinese Traditional and English
Japanese and English
Korean and English
Norwegian
Digits

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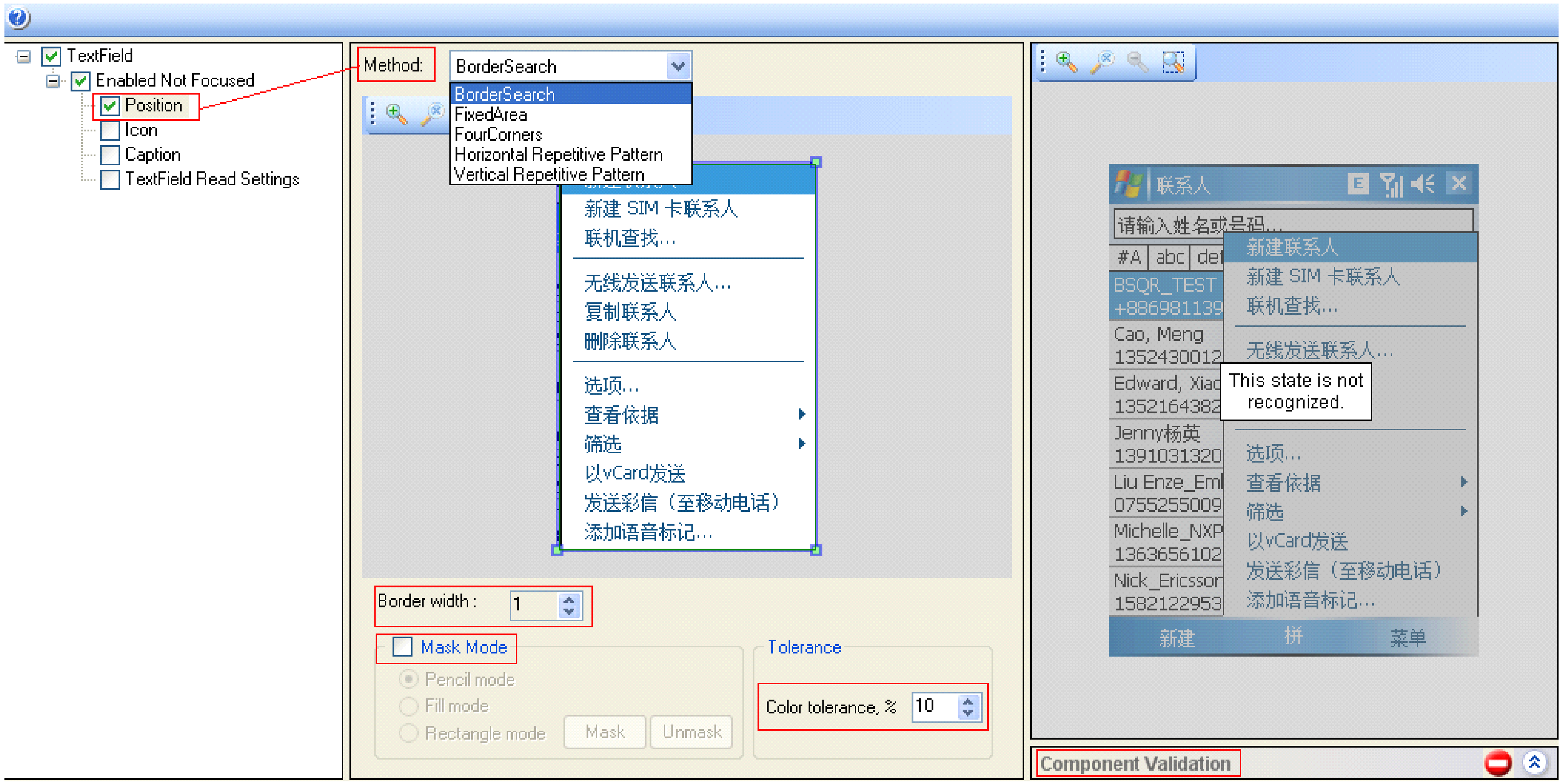
Intelligent Controls: Positioning

Control Positiong Methods: BoardSearch, FixedArea, FourConers, Horizontal Repetitive Pattern, Vertical Repetitive Pattern



[✓] TextField
[✓] Enabled Not Focused
[✓] Position

Method: BorderSearch

Border width : 1

[ ] Mask Mode

Tolerance

Color tolerance, % 10

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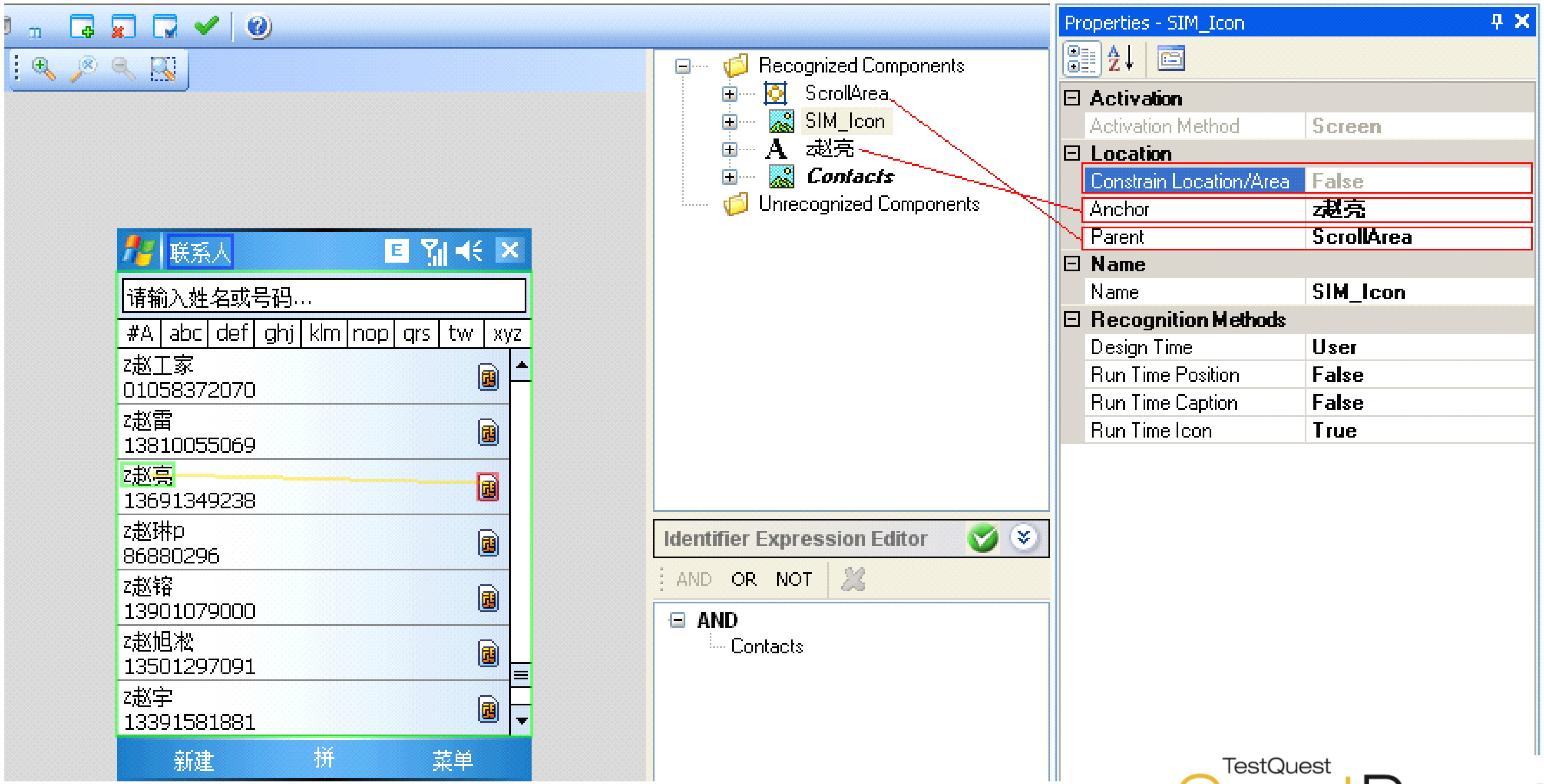
Intelligent Controls: Properties

Control Constrain Location/Area,

Parent,

Anchor



Properties - SIM_Icon

Activation	
Activation Method	Screen
Location	
Constrain Location/Area	False
Anchor	z赵亮
Parent	ScrollArea
Name	
Name	SIM_Icon
Recognition Methods	
Design Time	User
Run Time Position	False
Run Time Caption	False
Run Time Icon	True

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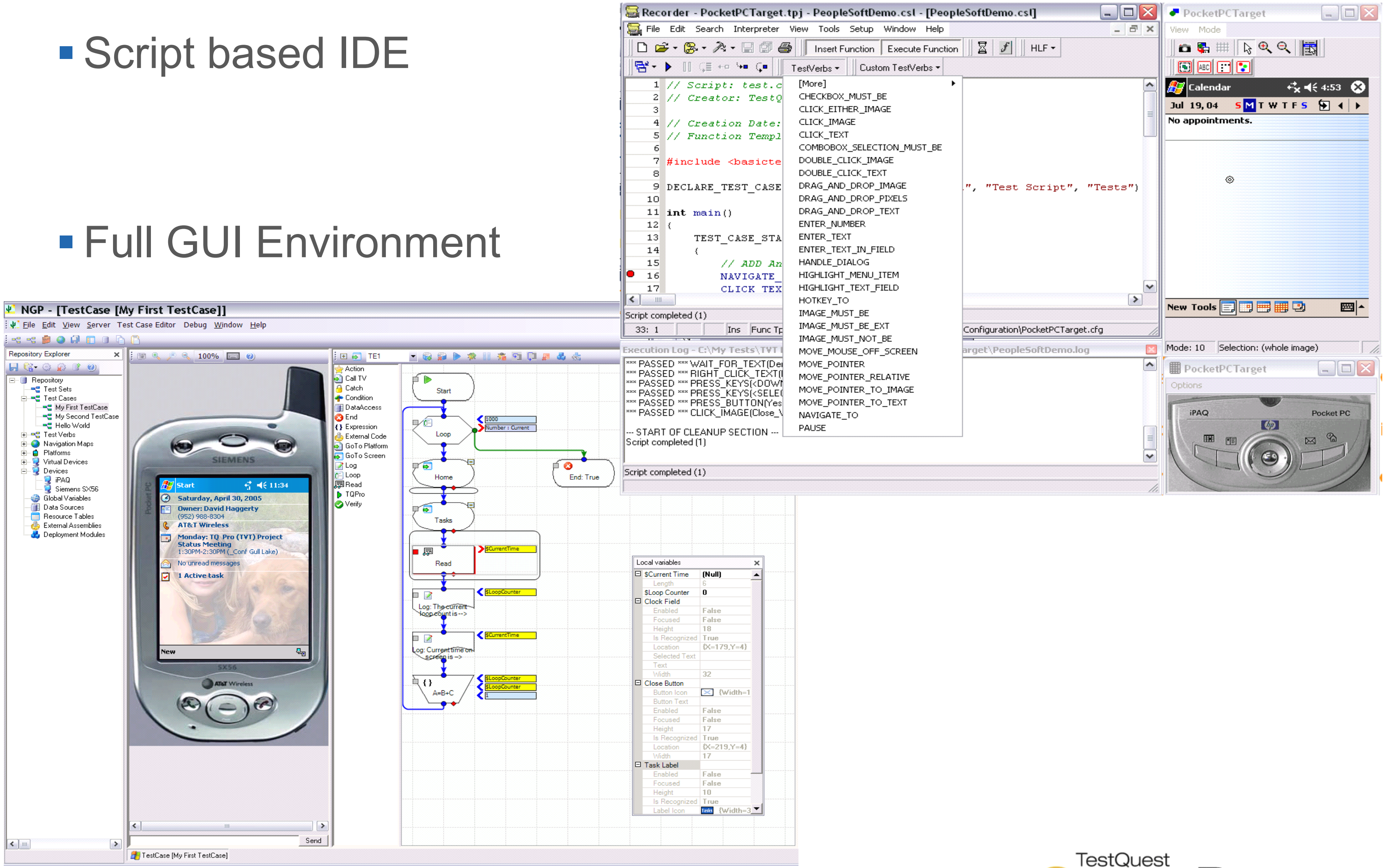
TestCase Design & Debug IDE

- Script based IDE
- Full GUI Environment



```
// Script: test.c
// Creator: TestQ

// Creation Date:
// Function Templ

#include <basicte

DECLARE_TEST_CASE                                   ", "Test Script", "Tests")

int main()
{
    TEST_CASE_STA
    {
        // ADD An
        NAVIGATE_
        CLICK TEX
```

```
Script completed (1)
33: 1    Ins    Func Tp    Configuration\PocketPCTarget.cfg
```

```
Execution Log - C:\My Tests\TVT               arget\PeopleSoftDemo.log
*** PASSED *** WAIT_FOR_TEXT(De
*** PASSED *** RIGHT_CLICK_TEXT(
*** PASSED *** PRESS_KEYS(<DOW
*** PASSED *** PRESS_KEYS(<SELE
*** PASSED *** PRESS_BUTTON(Yes
*** PASSED *** CLICK_IMAGE(Close_\

--- START OF CLEANUP SECTION ---
Script completed (1)

Script completed (1)
```

Local variables

$Current Time	(Null)
Length	6
$Loop Counter	0
Clock Field	
Enabled	False
Focused	False
Height	18
Is Recognized	True
Location	{X=179,Y=4}
Selected Text	
Text	
Width	32
Close Button	
Button Icon	{Width=1
Button Text	
Enabled	False
Focused	False
Height	17
Is Recognized	True
Location	{X=219,Y=4}
Width	17
Task Label	
Enabled	False
Focused	False
Height	10
Is Recognized	True
Label Icon	{Width=3

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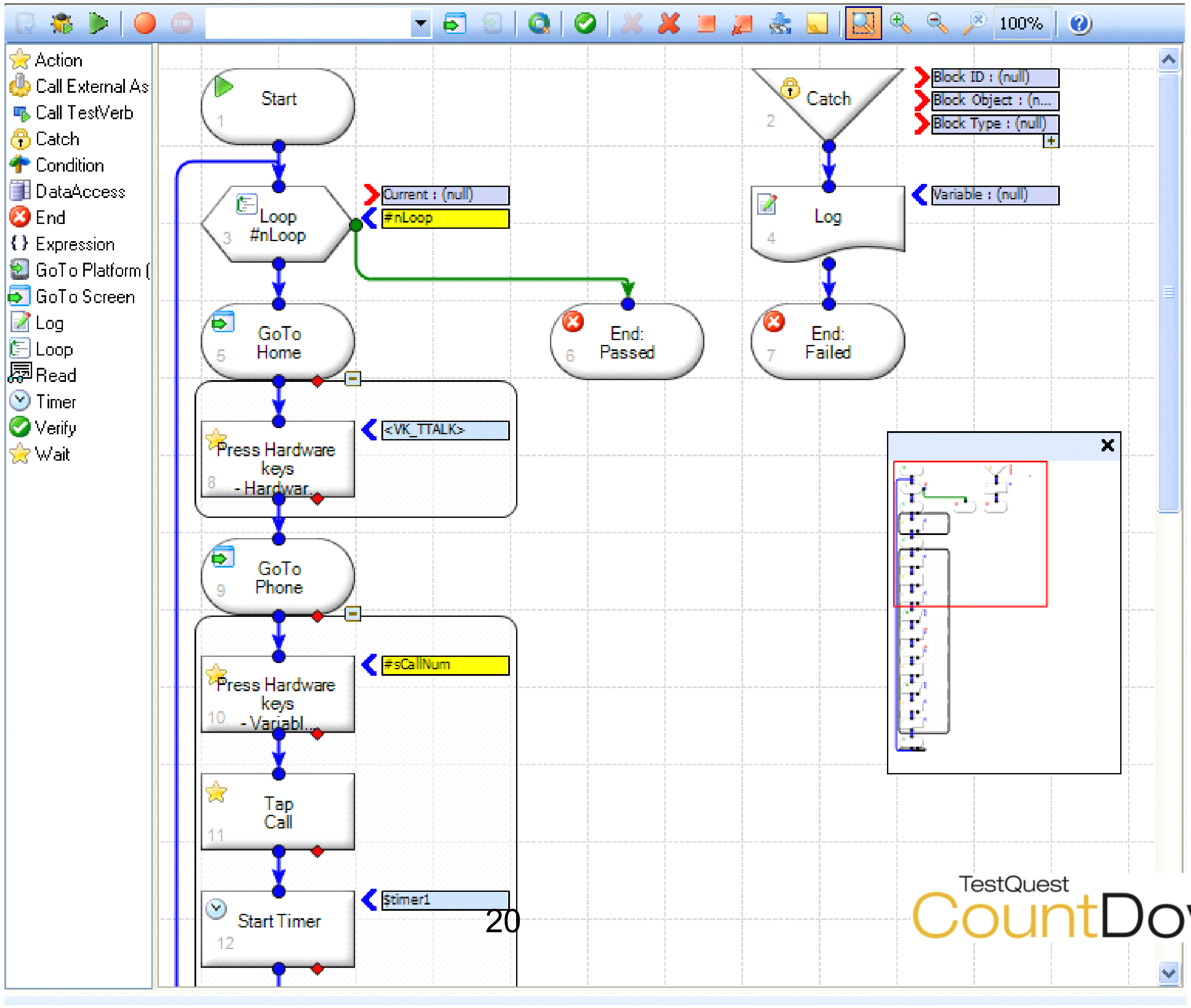
TestCase in C-Like Scripts

A Test Script to Send SMS/EMS

```
//ZZZ
// Test Case Name: 02.02.04.01
// Test Case Description: Forward EMS message to MDN (Automation)
// Automated Test Case File: SMS_EMS_02_02_04_01.csl
// Creator: Auto-generated
// Creation Date: 09/23/05

#include <basictest.h>

//DECLARE_TEST_CASE(
//"",  Gives a name that can be used for debugging.  Usually the product name.
//"atc1.csl",  The name of the file that contains the automated test case.
//"atc1",  The abstracted name of the automated test case.
//"")  A description of the automated test case.

DECLARE_TEST_CASE("", "SMS_EMS_02_02_04_01.csl", "02.02.04.01", "")

int main()
{
    TEST_CASE_START()
    {
        //Preconditions - START

        // SETUP, Need to have and SMS and four EMS messages in SENT folder on A as follows:
        //   ALPHA = one with a graphic object
        //   BETA  = one with a sound object
        //   GAMMA = one with both a graphic and a sound object
        //   ZETA  = one with 2 segments of text (done just prior to test case)

        // EMS WITH GRAPHIC AND SOUND
        SWITCH_TARGET_BYNAME("MobileA");
        NAVIGATE_TO("New TXT Msg");
        ENTER_NUMBER("MOBILE_B_MDN");
        PRESS_SOFTKEY("OK");
        ATTACH_GRAPHIC_FROM_TEXT_COMPOSER("TESTGRAPHIC1");
        ENTER_TEXT(" ");                                               // so the sound graphic is not hidden
        ATTACH_SOUND_FROM_TEXT_COMPOSER("TESTSOUND1");
        ENTER_TEXT(" GAMMA");
        PRESS_KEYS("<Send>");

        SWITCH_TARGET_BYNAME("MobileB");
        WAIT_FOR_MESSAGE("GAMMA");
        RETURN_TO_IDLE();
```

TestCase in Full GUI Environment

A Full GUI TestCase to Test Phone Calls



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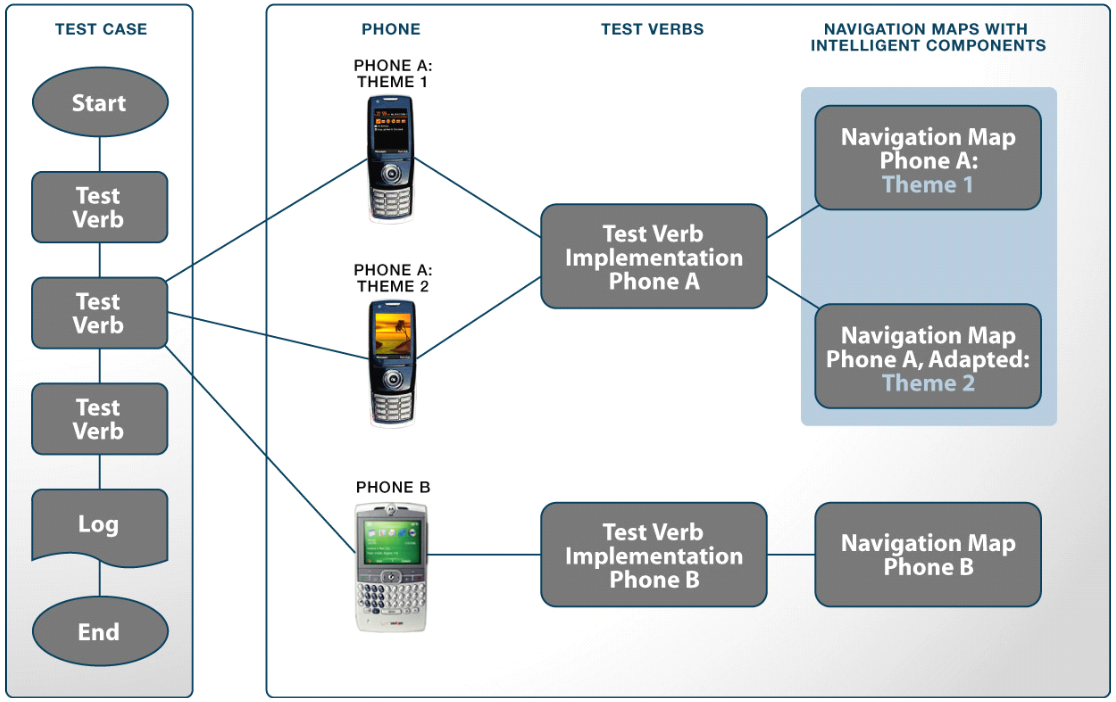
TestCase Reuse

– Adaptive TestCase Technology

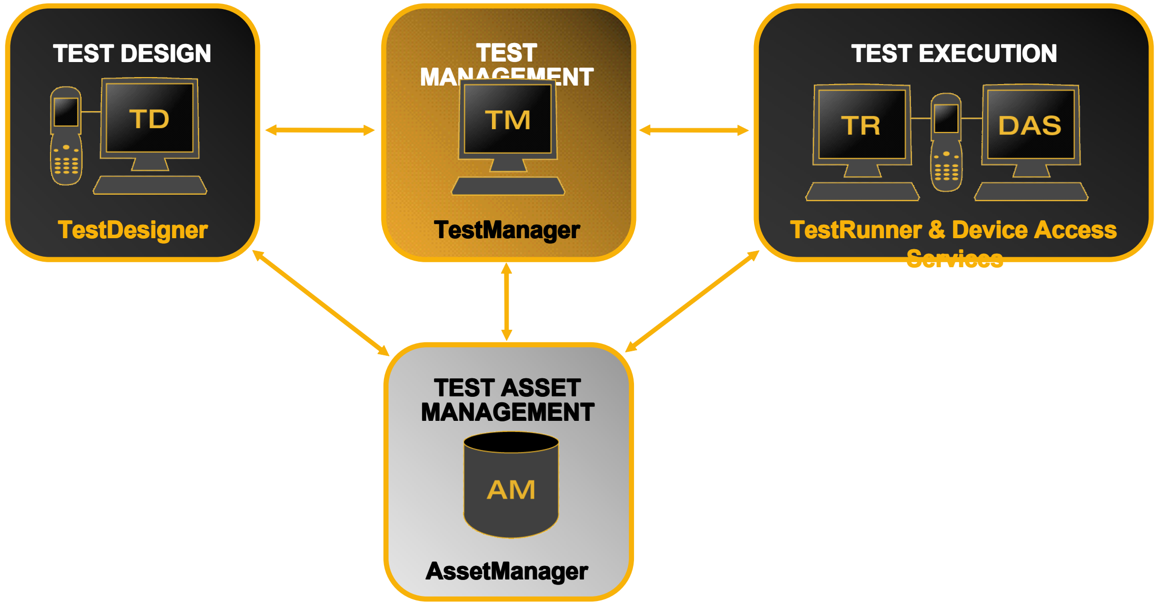


TEST CASE
Start
Test Verb
Test Verb
Test Verb
Log
End
PHONE
PHONE A: THEME 1
PHONE A: THEME 2
PHONE B
TEST VERBS
Test Verb Implementation Phone A
Test Verb Implementation Phone B
NAVIGATION MAPS WITH INTELLIGENT COMPONENTS
Navigation Map Phone A: Theme 1
Navigation Map Phone A, Adapted: Theme 2
Navigation Map Phone B

- Device model variations (e.g., theme, display resolution or language) are absorbed by navigation maps with intelligent components
- Platform variations (i.e., differences across device models or operating systems) are absorbed by TestVerbs
- Test cases do not change

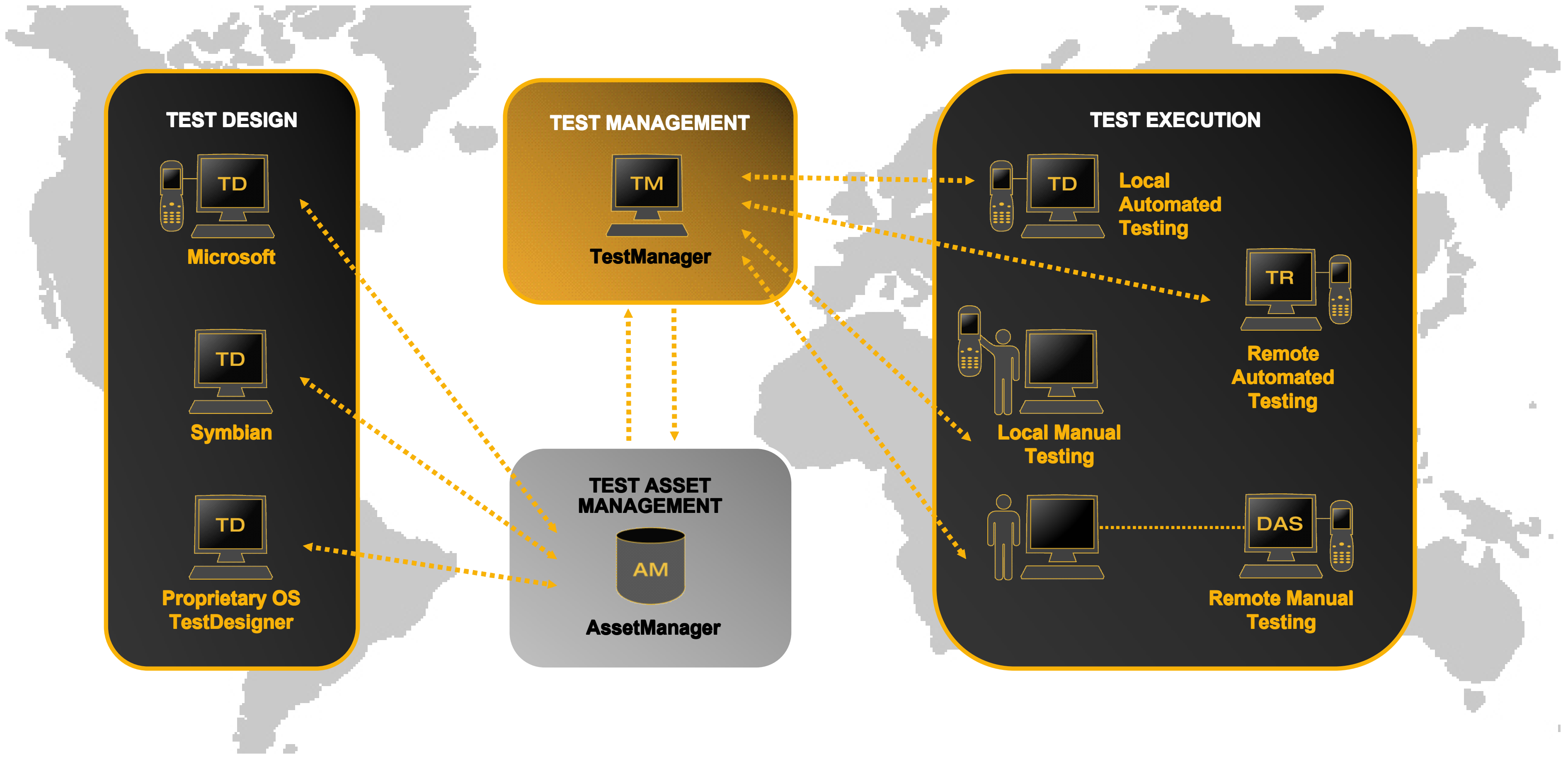
TestCase Management and Sharing

- Modular Design
  - Test Repository
  - Test Design & Debug
  - Test Execution
  - Test Management
- Distributive System



TestCase Management and Sharing

- Deployment Enables Collaborative and Distributed Testing Globally



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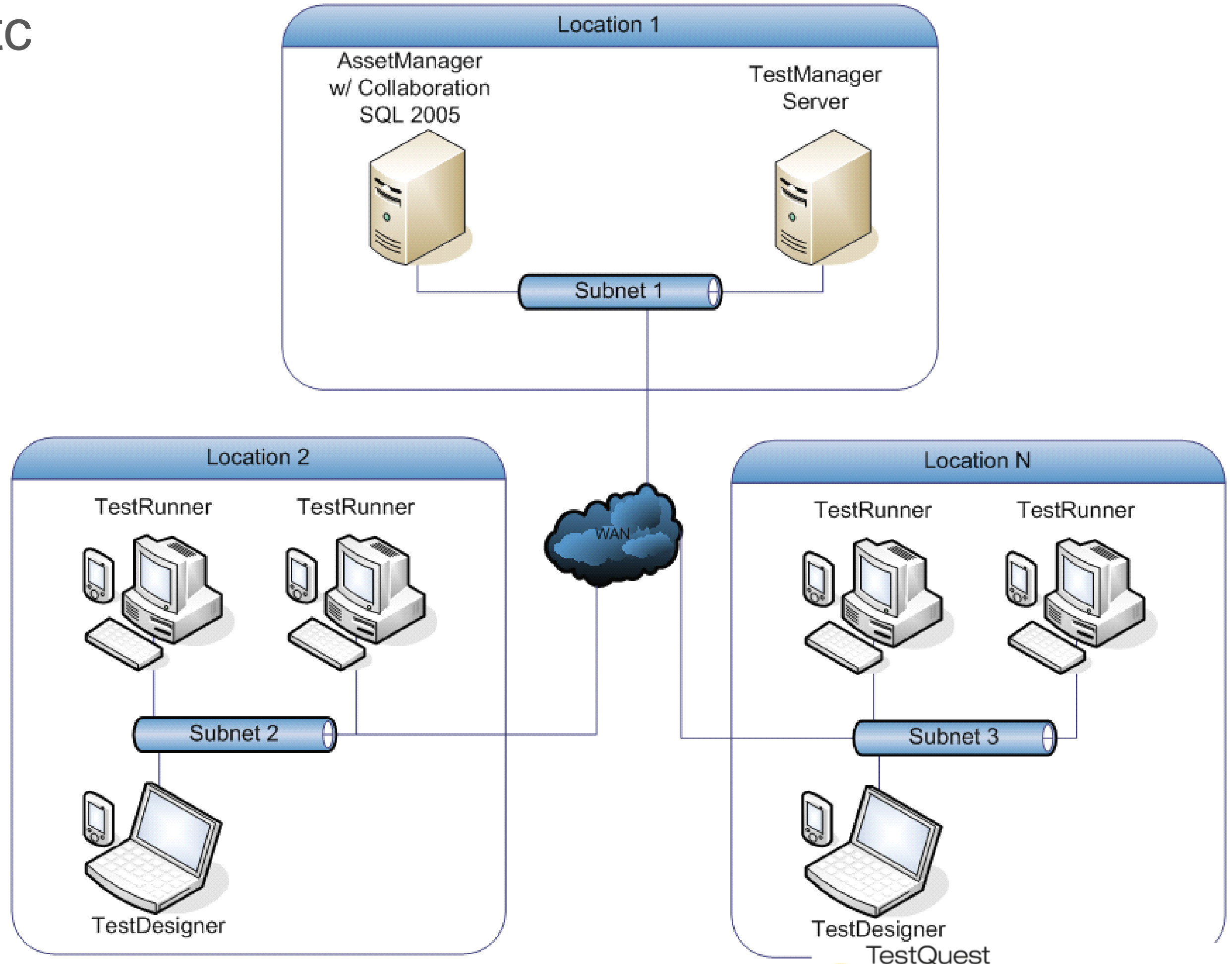
TestCase Management and Sharing

- Deployment Enables Test Assets Sharing across the Mobile and Wireless Value Chain – Carriers, ODM/OEMs, Chipset Vendors, ISVs, etc



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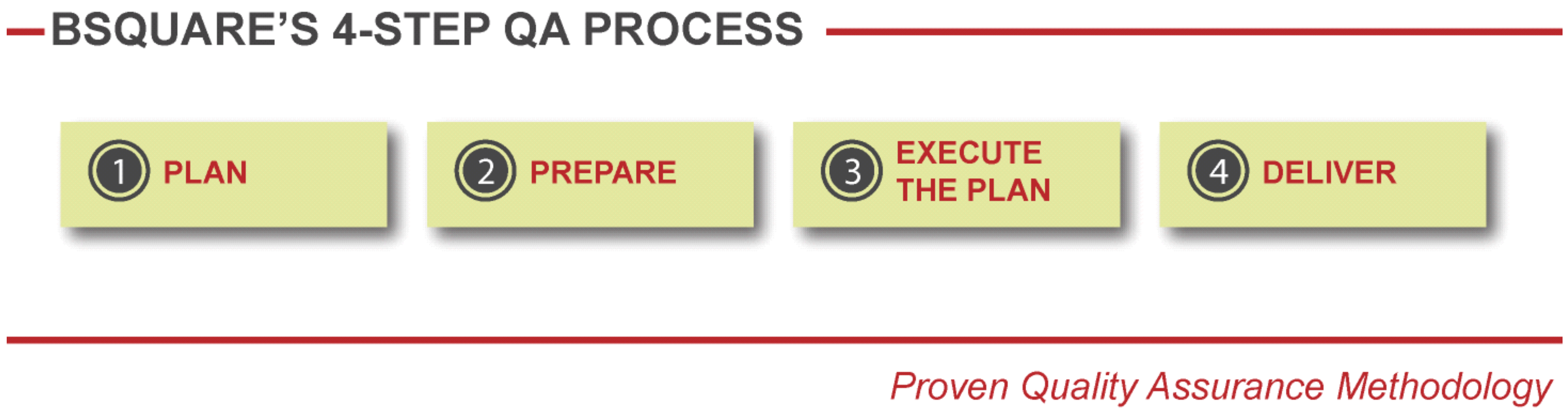
A Proven QA Methodology

- BSQUARE Quality Assurance Process Overview


BSQUARE'S 4-STEP QA PROCESS
1 PLAN
2 PREPARE
3 EXECUTE THE PLAN
4 DELIVER
Proven Quality Assurance Methodology

QA STEP 1: Plan the Test Strategy

1 PLAN
2 PREPARE
3 EXECUTE THE PLAN
4 DELIVER

- Understand all Requirements
  - Product specs, Microsoft specs
- Identify Test Coverage
- Identify Tools
- Identify Teams
- Identify Gaps

QA STEP 2: Prepare the Test Strategy

1 PLAN | **2 PREPARE** | 3 EXECUTE THE PLAN | 4 DELIVER

- Create test documentation
  - Test Plan
  - Test Design Specification
  - Test Case Specification
  - Test Report Summary
- Set up test environment, and defect tracking system
- Develop test scripts and user scenarios

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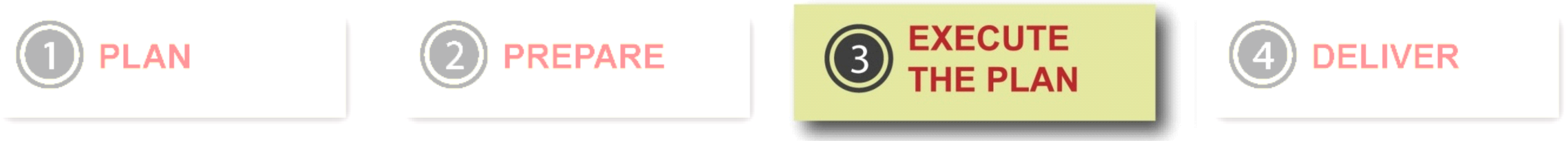
QA STEP 3: Execute the Test Strategy



- System Testing
- Testing Sequence for Code Complete Drop
  - Test Pass #1 (Platform, User Scenarios, Integration, Stress, Performance)
  - Windows Mobile LTK
  - Defect Verification
  - Regression Testing
  - Final Test Pass (Platform, User Scenarios, Integration, Stress, Performance)
  - Windows Mobile LTK (Hopper)
  - Final Verification
- Includes Acceptance Criteria and Allowable Defect Levels based on the Statement of Work (SOW)

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QA STEP 4: Deliver the Test Results

1 PLAN | 2 PREPARE | 3 EXECUTE THE PLAN | 4 DELIVER

- Updated Test Documents
  - Test Plan
  - Test Design Specification
  - Customer follow-on regression testing can be provided
- QA Summary Reports:
  - Defect Information
  - Test Environment
  - Test Result summary
  - Comprehensive Assessment

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BSQUARE: Comprehensive QA Testing

QUALITY ASSURANCE AREA

	COMMON CHALLENGES:	BSQUARE'S SOLUTIONS
PLATFORM	Deep understanding of the Widows CE and Windows mobile architectures is critical	▪ BSQUARE Test Scripts ▪ CETK Test Scripts ▪ BSQUARE's library of manual scripts
APPLICATIONS	Custom, 3rd-Party, and built in applications and GUI's all require extensive testing	▪ BSQUARE identifies, creates, and automates application tests ▪ BSQUARE's library of application test scripts
USER SCENARIOS	The more sophisticated the device, the more scenarios that require testing	▪ TestQuest CountDown™ and automates test scenarios ▪ BSQR common user scenarios
SYSTEM	The fully integrated system must be thoroughly tested for stability and usability	▪ BSQR CEV Stress Test scripts ▪ CETK Stress Test scripts ▪ BSQR Perf benchmarks tools
CERTIFICATION	Methodology, tools and experience are necessary to meet tough requirements	▪WM LTK Pre Certification ▪WM Hopper: early & often

TestQuest CountDown™

BSQUARE Profile

- Founded in 1994, IPO in 1999 (NASDAQ:BSQR)
- Worked with Microsoft to create Windows CE
- Headquartered in Bellevue, WA
- Worldwide operations, 300 headcount, including 200 in Professional Engineering Services (PES)
- Acquired TestQuest in Nov 2008 TestQuest CountDown™
- Recognized by leading OEMs and ODMs as Windows Embedded experts
- Close more than 700+ project during 15 years

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Thank You!

- Q&A
- BSQUARE TestQuest CountDown Demo

TestQuest CountDown™