Quels outils pour gérer et valider de "gros" projets sous LabVIEW ?

Laurent VAYLET

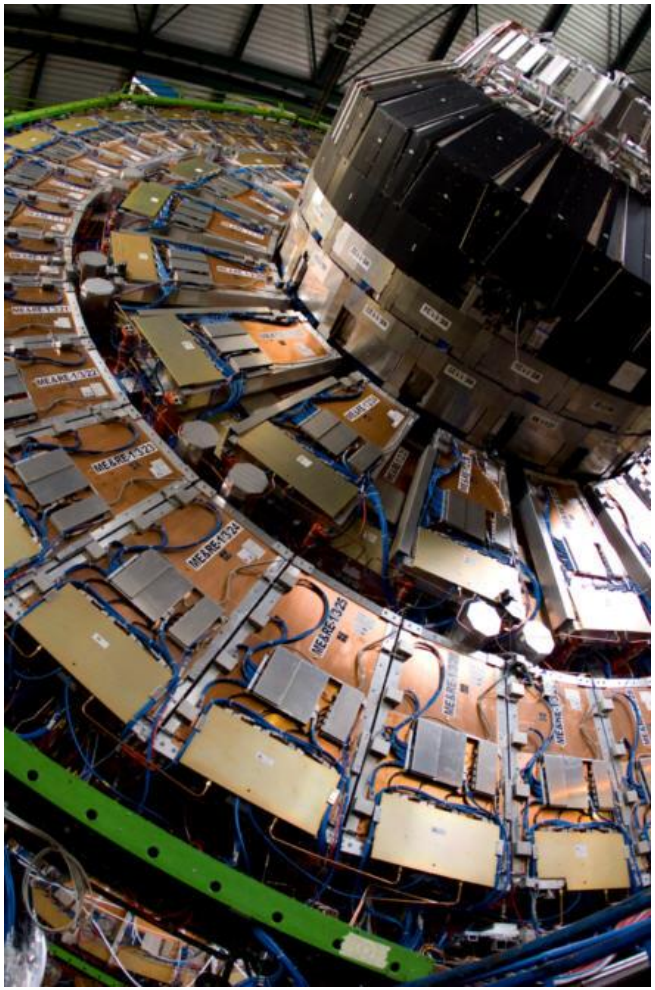
Ingénieur Produits pour l'Enseignement et la Recherche

NATIONAL INSTRUMENTS

Sommaire

- Enjeux liés aux applications critiques et/ou volumineuses
- Outils disponibles sous LabVIEW
  - Contrôle de code source
  - Traçabilité des exigences
  - Architecture
  - Développement et documentation
  - Analyse, débogage et validation
  - Déploiement
- Formations, certifications

LabVIEW au CERN - Large Hadron Collider



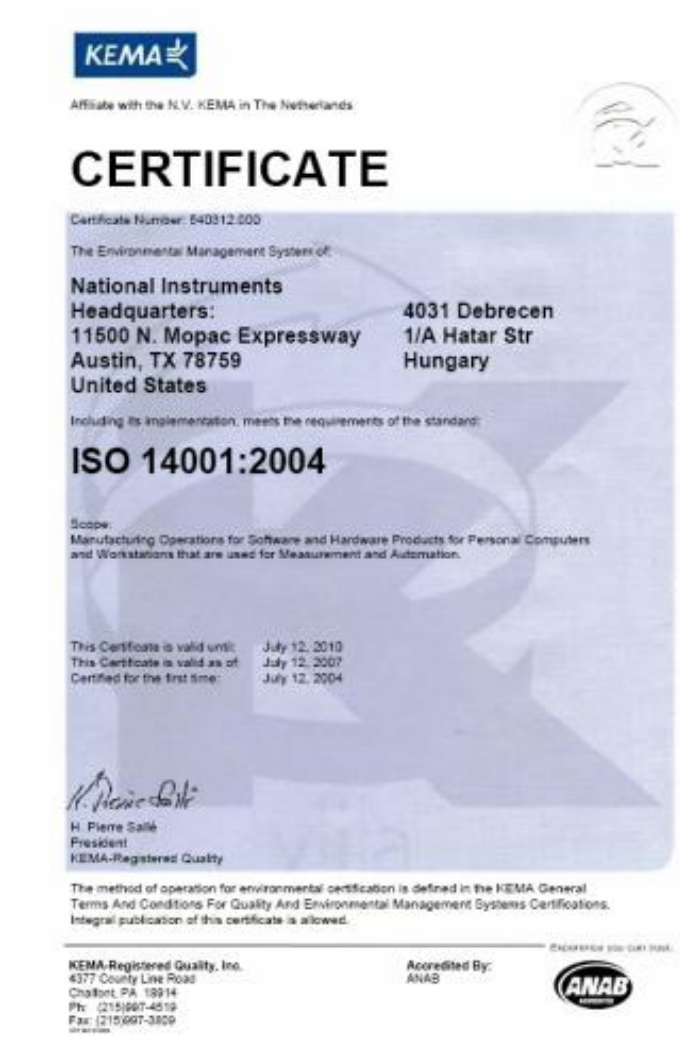
- Anneau de 27 km
- 200 châssis PXI + FPGA
- 600 moteurs pas-à-pas
- dT = 1 ms

Application critique

- Implique beaucoup d'argent
- Peut occasionner de sérieux dommages aux personnes
- Peut ternir la réputation de la société

- Évalué
- Validé
- Documenté

« Et LabVIEW, il est certifié ? »



KEMA

Affiliate with the N.V. KEMA in The Netherlands

CERTIFICATE

Certificate Number: 640312.000

The Environmental Management System of:

National Instruments
Headquarters:
11500 N. Mopac Expressway
Austin, TX 78759
United States

4031 Debrecen
1/A Hatar Str
Hungary

Including its implementation, meets the requirements of the standard:

ISO 14001:2004

Scope:
Manufacturing Operations for Software and Hardware Products for Personal Computers and Workstations that are used for Measurement and Automation.

This Certificate is valid until: July 12, 2010
This Certificate is valid as of: July 12, 2007
Certified for the first time: July 12, 2004

H. Pierre Sallé
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KEMA-Registered Quality

The method of operation for environmental certification is defined in the KEMA General Terms And Conditions For Quality And Environmental Management Systems Certifications. Integral publication of this certificate is allowed.

KEMA-Registered Quality, Inc.
4377 County Line Road
Chalfont, PA 18914
Ph: (215)997-4519
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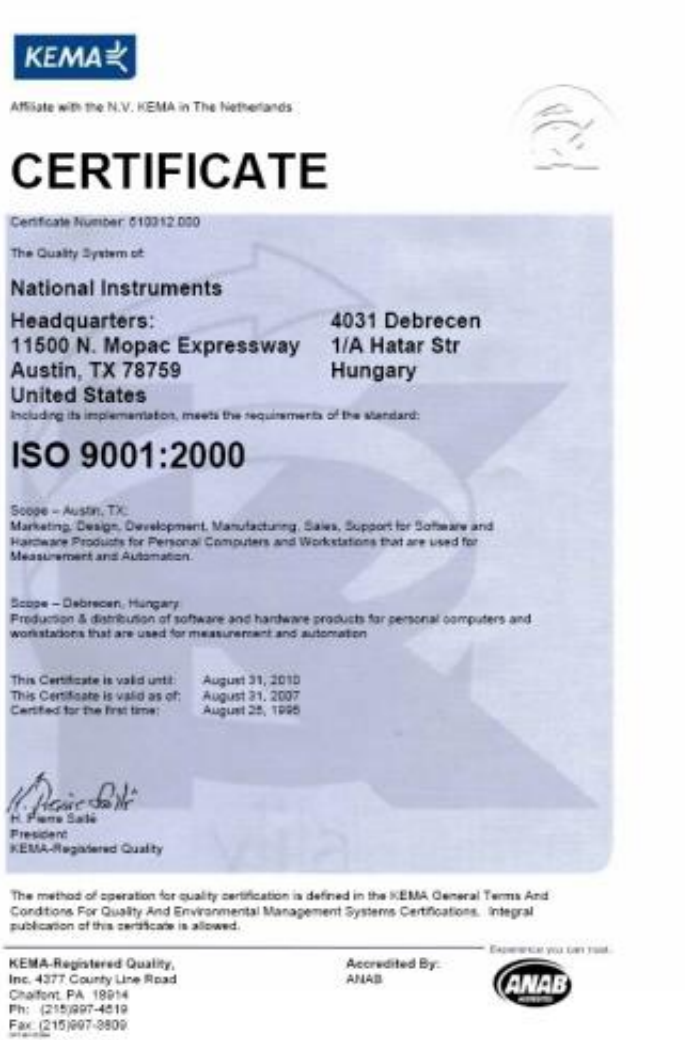

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Certificate Number: 510312.000

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Austin, TX 78759
United States

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ISO 9001:2000

Scope – Austin, TX:
Marketing, Design, Development, Manufacturing, Sales, Support for Software and Hardware Products for Personal Computers and Workstations that are used for Measurement and Automation.

Scope – Debrecen, Hungary:
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Certified for the first time: August 25, 1995

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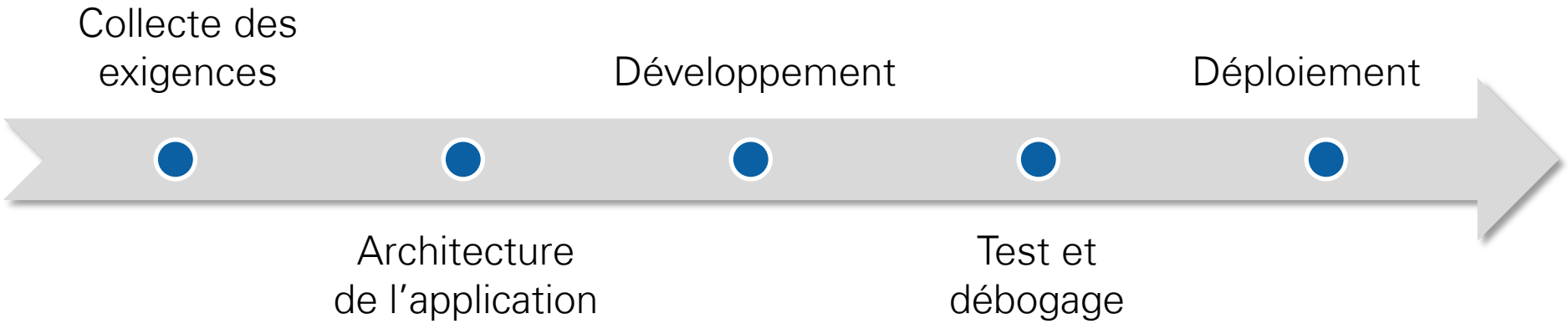
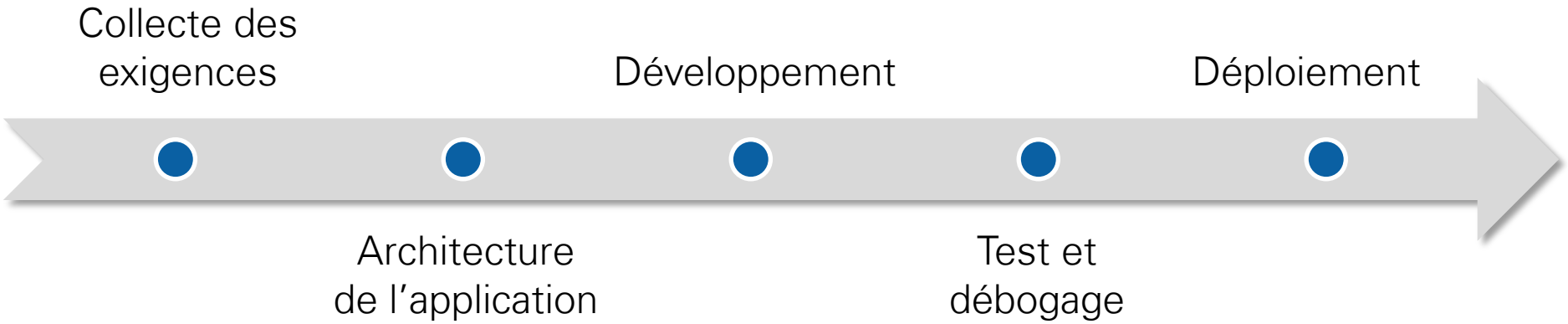
NATIONAL INSTRUMENTS

Le processus de génie logiciel



Prouver le bon fonctionnement

Améliorer la qualité. Réduire le risque. Gagner du temps.



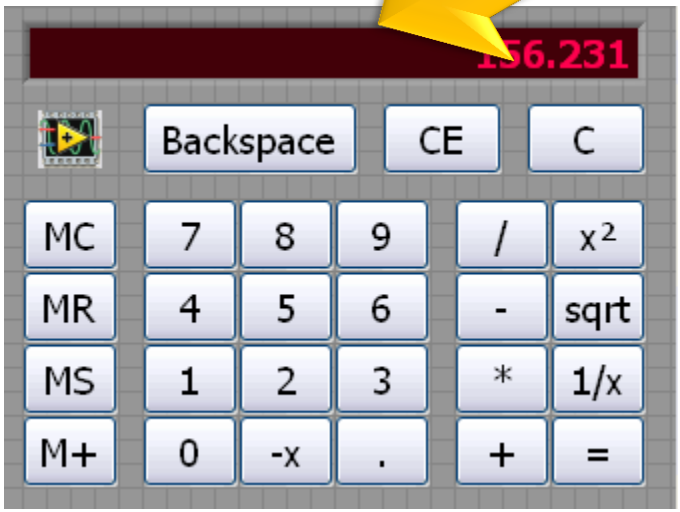
Outils pour le travail collaboratif

Contrôle de code source

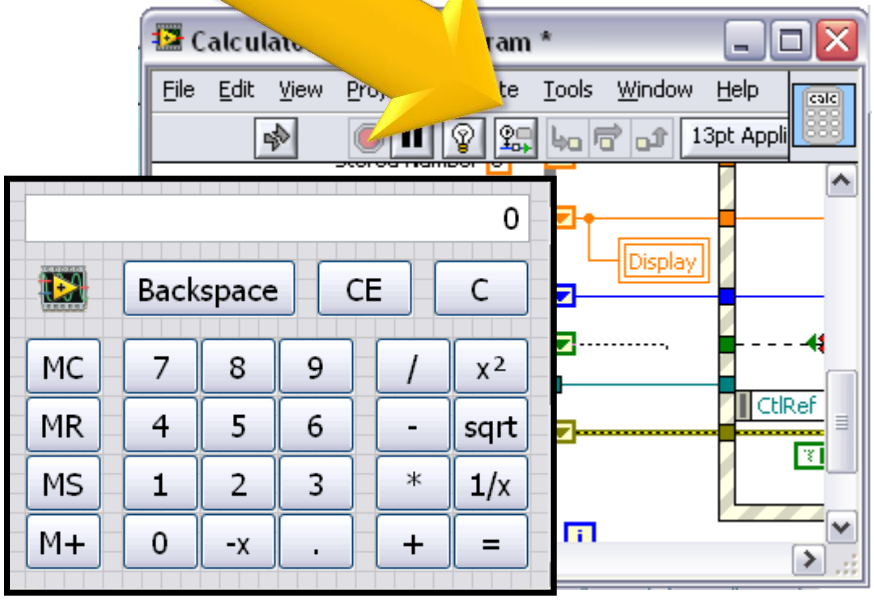
Répertoire de dépôt

Développeur 1

Développeur 2



Changement de couleur de la Face Avant



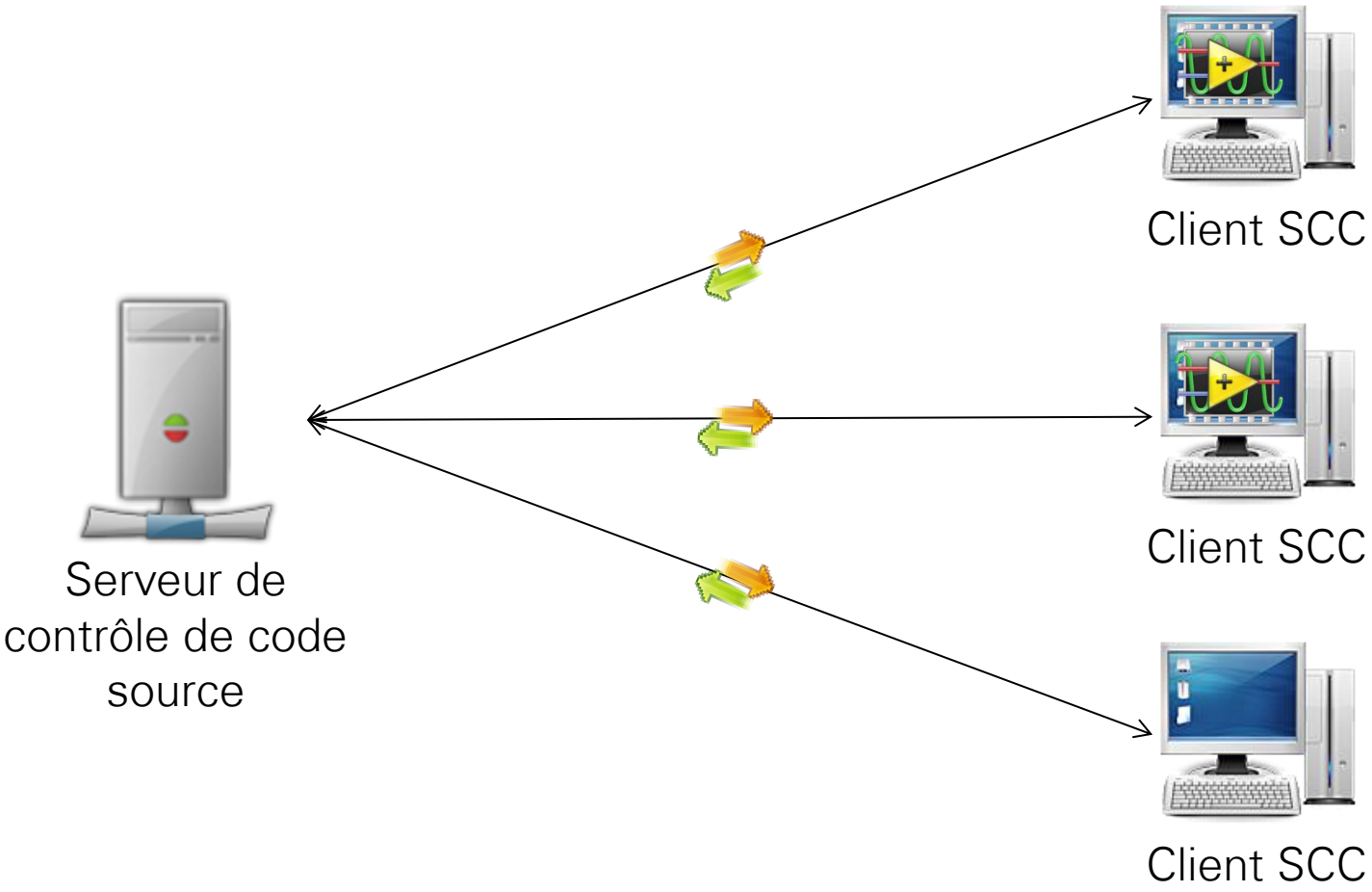
Changement de comportement dans le diagramme

NATIONAL INSTRUMENTS

Contrôle de code source

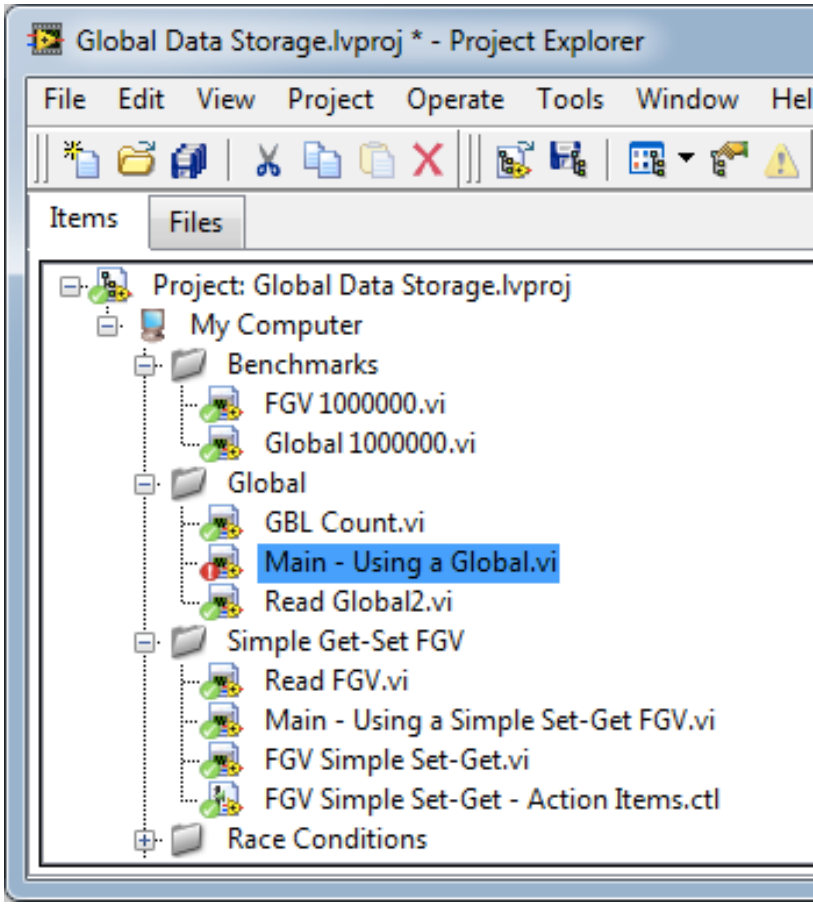
La version finale tient compte des deux modifications

LabVIEW et les SCC (Source Code Control)

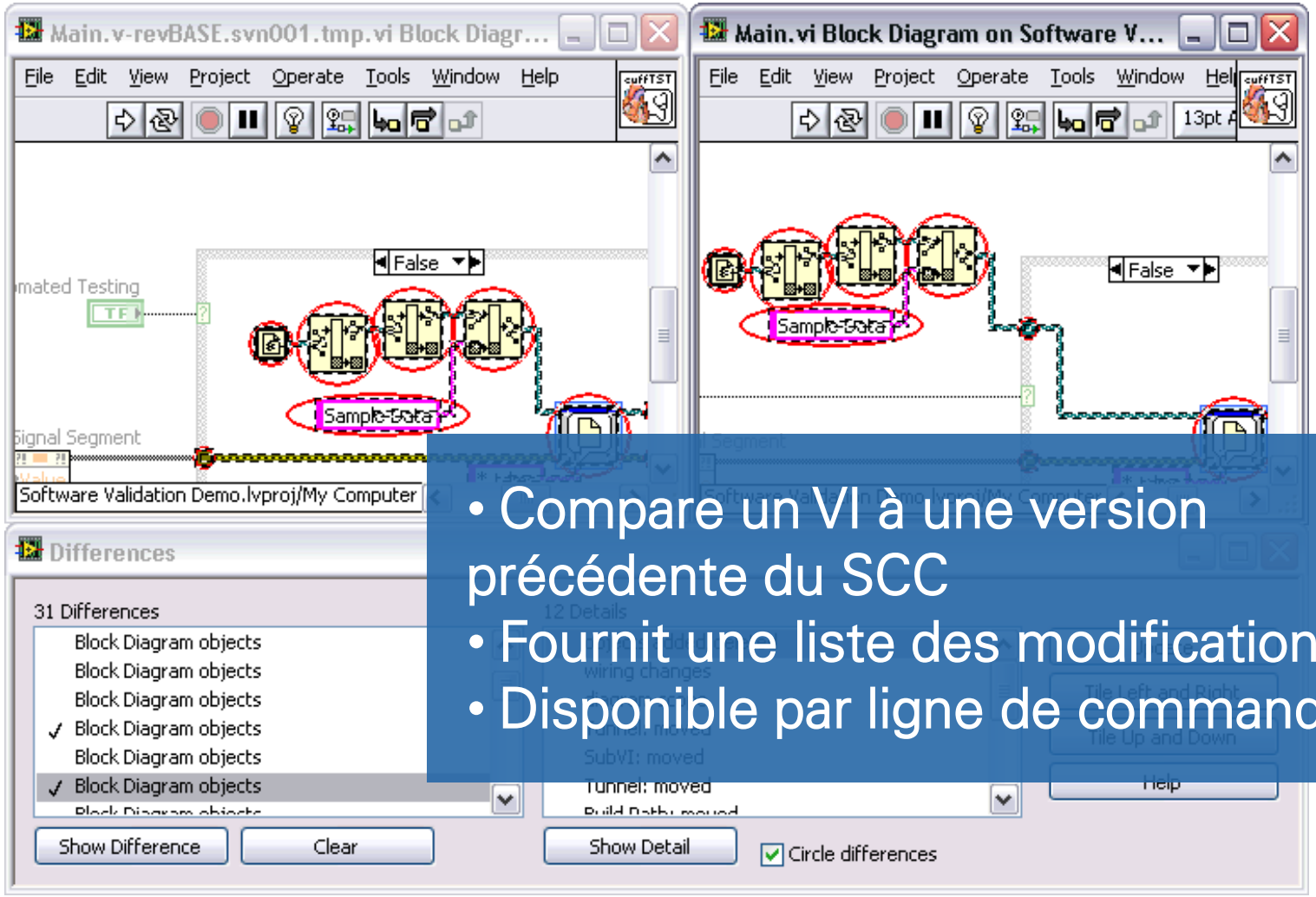


Quels sont les serveurs accessibles ?

- Intégration avec :
  - Subversion
  - Microsoft Visual SourceSafe
  - Microsoft Team System
  - Perforce
  - Rational ClearCase
  - PCVS (Serena) Version Manager
  - MKS Source Integrity
  - Seapine Surround SCM
  - Borland StarTeam
  - Telelogic Synergy
  - ionForge Evolution
- Accès aux outils SCC depuis le projet LabVIEW



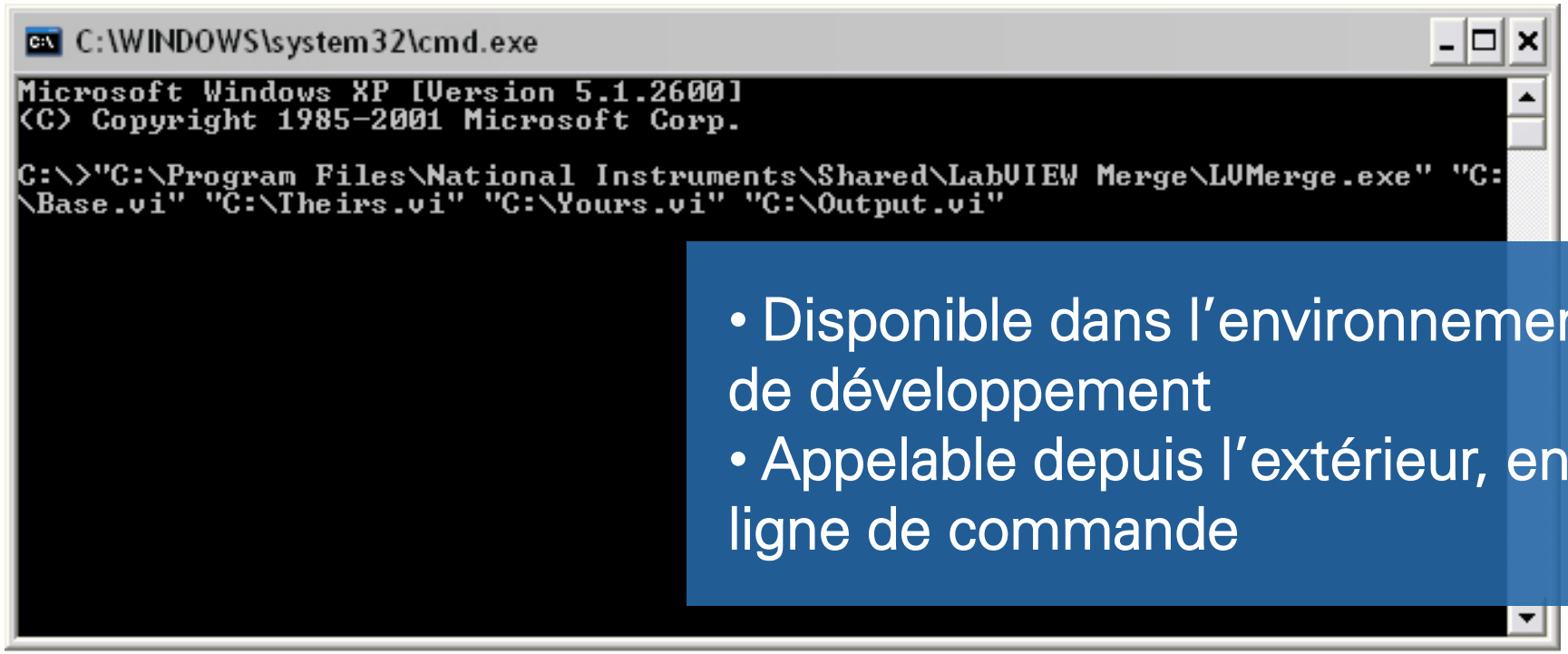
Outils » Comparer » Comparer des VIs



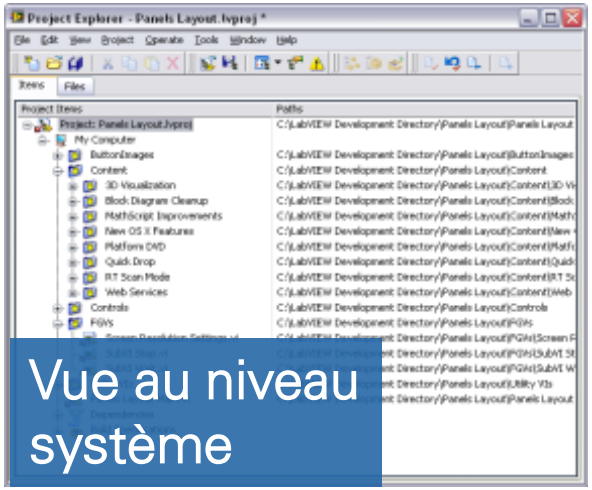
- Compare un VI à une version précédente du SCC
- Fournit une liste des modifications
- Disponible par ligne de commande

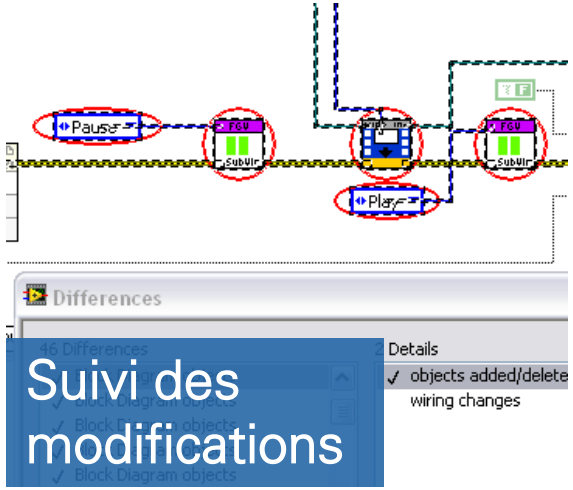
Résoudre les collisions de code

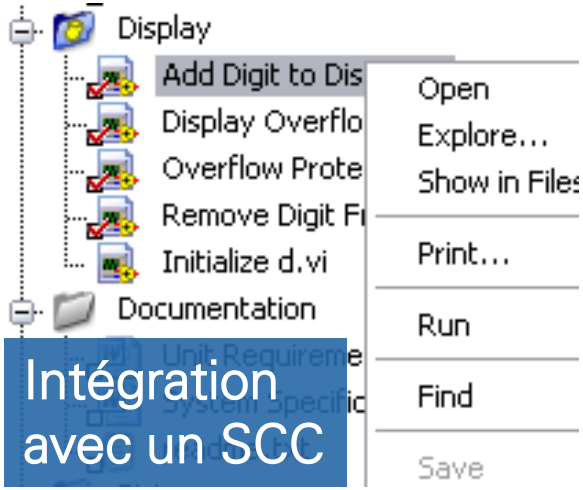
- Fusion manuelle
- VI Merge (depuis LabVIEW 8.5)

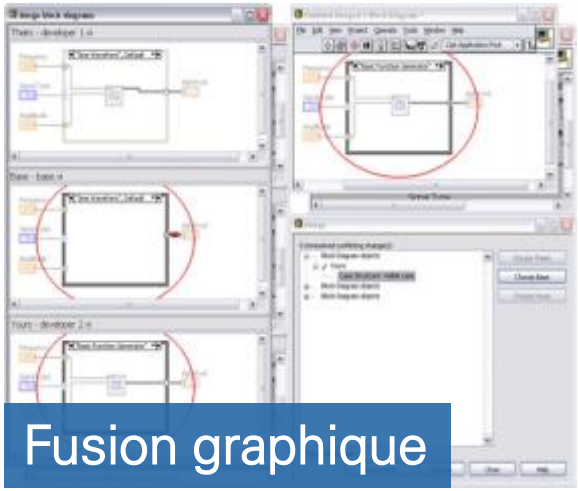


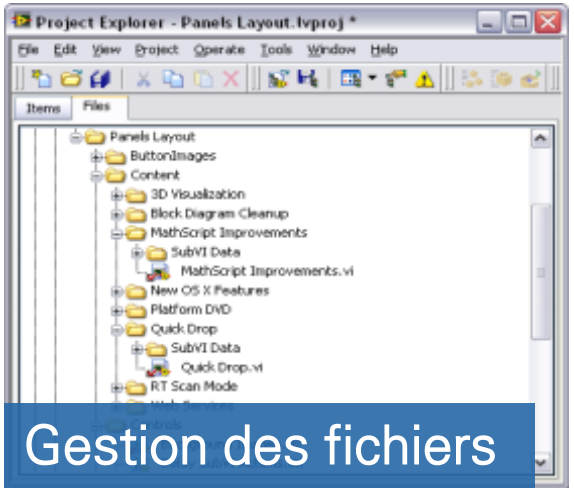
Gestion de configuration logicielle pour LabVIEW

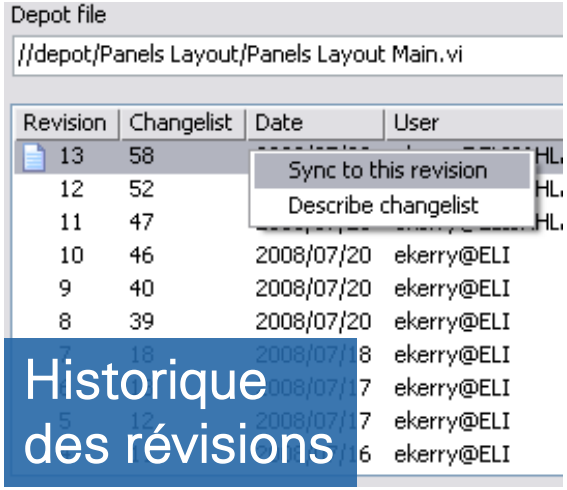


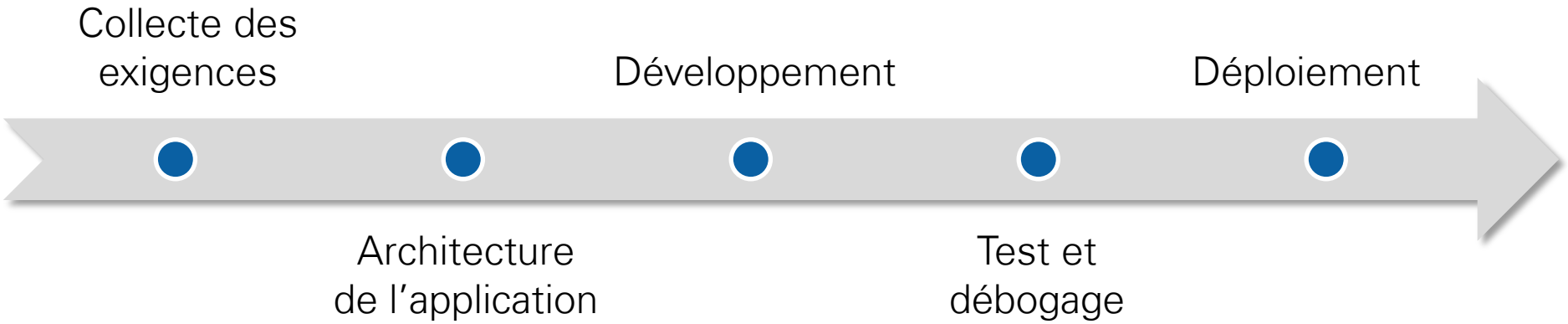












Outils pour le processus de génie logiciel

NATIONAL INSTRUMENTS

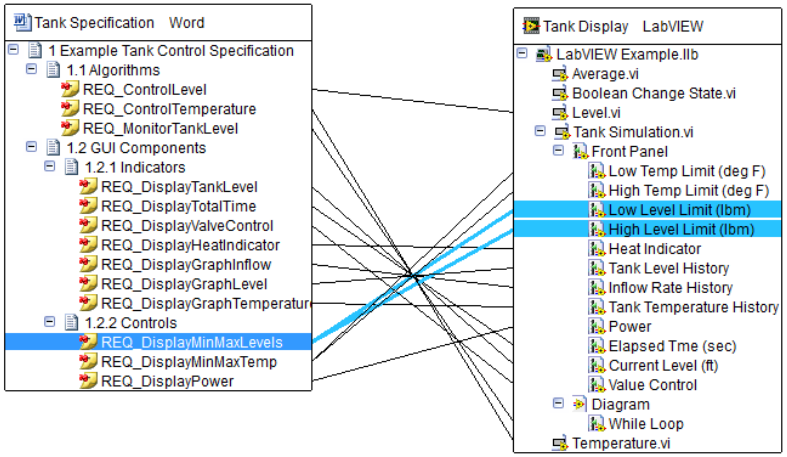
Collecte des exigences

Développement

Déploiement

Architecture de l'application

Test et débogage

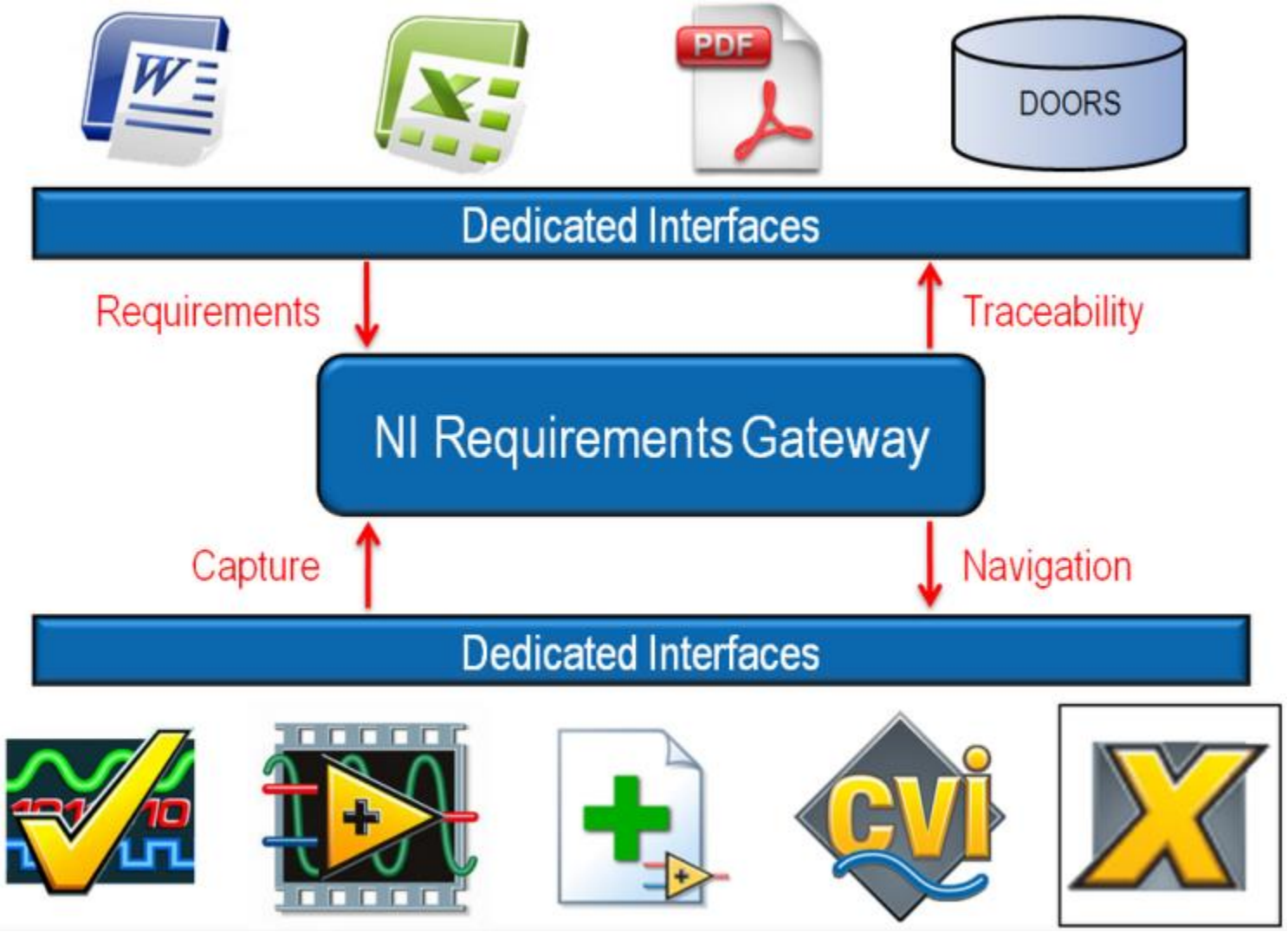


Upstream	Text	Downstream
REQ_ControlLevel	The application must maintain a separate control algorithm for controlling tank levels.	Level.vi
REQ_ControlTemperature	The application must maintain a separate control algorithm for controlling temperature.	Temperature.vi
REQ_DisplayGraphInflow	The display must display a graph indicating the inflow rate.	Inflow Rate History
REQ_DisplayGraphLevel	The display must contains a graph indicating the tank level.	Tank Level History
REQ_DisplayGraphTemperature	The display must contains a graph indicating the tank temperature.	Tank Temperature History
REQ_DisplayHeatIndicator	The display must show whether furnace is on or off.	Heat Indicator
REQ_DisplayMinMaxLevels	The display must allow the operator to control the minimum and maximum levels for the tank.	Low Level Limit (lbm)
REQ_DisplayMinMaxLevels	The display must allow the operator to control the minimum and maximum levels for the tank.	High Level Limit (lbm)
REQ_DisplayMinMaxTemp	The display must allow the operator to control the minimum and maximum levels for the tank temperature.	Low Temp Limit (deg F)

Couverture des exigences et suivi du projet

Traçabilité et génération de la documentation

NI Requirements Gateway

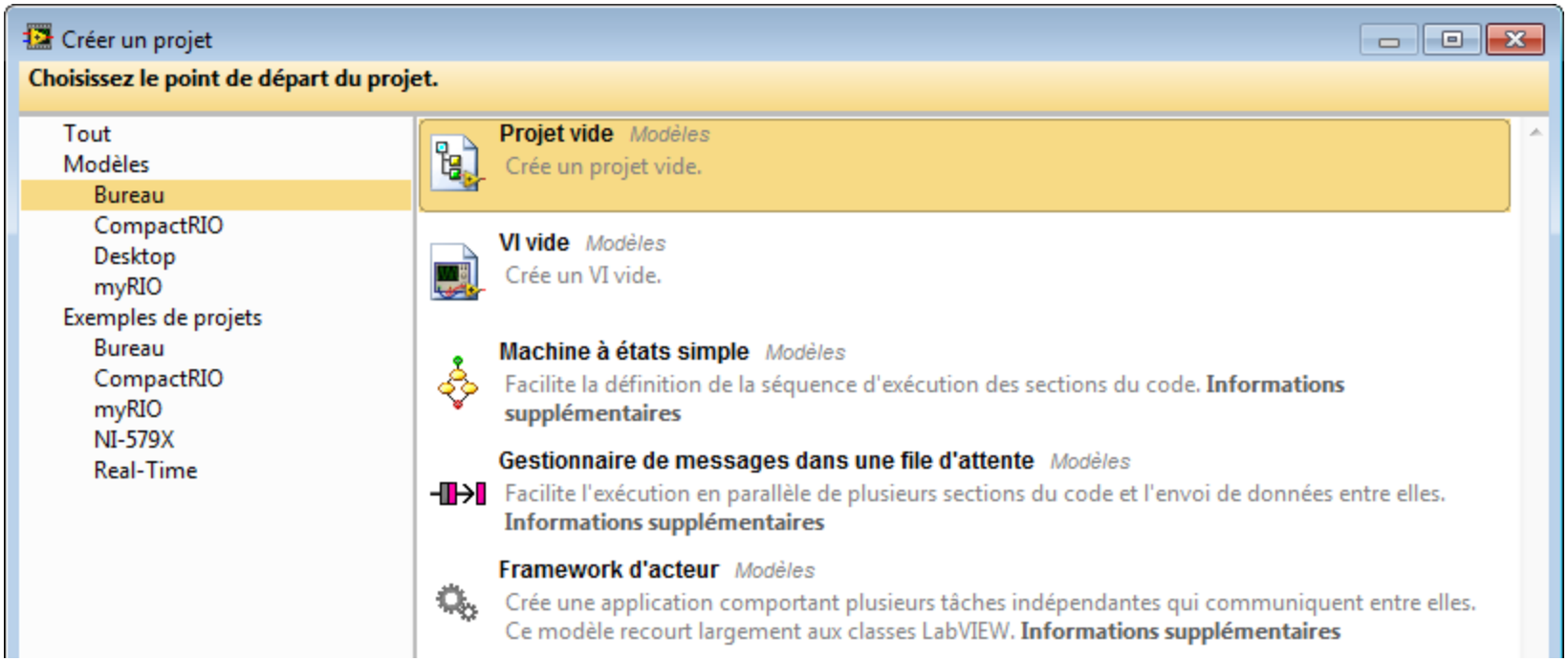


Buts

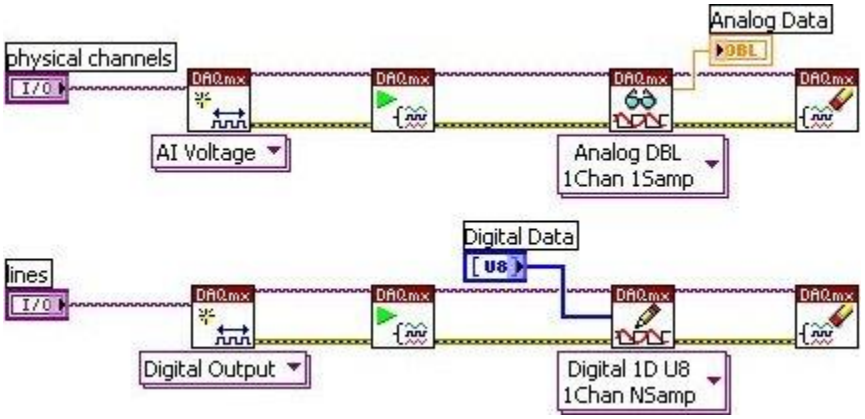
- Déterminer comment le code sera réparti sur l'équipe
- Vérifier que les codes sont lisibles et maintenables
- Maximiser la réutilisation et tirer avantage des structures ou fonctionnalités existantes

Les modèles de conception LabVIEW

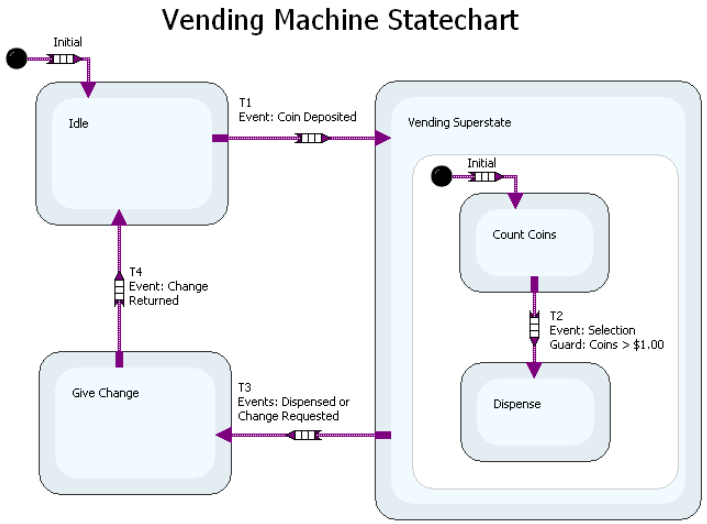
- Squelettes standards, faciles à reconnaître
- Améliorent la lisibilité du code
- Évitent de réinventer la roue
- Tirent avantage de plus de 20 années d'expérience en LabVIEW



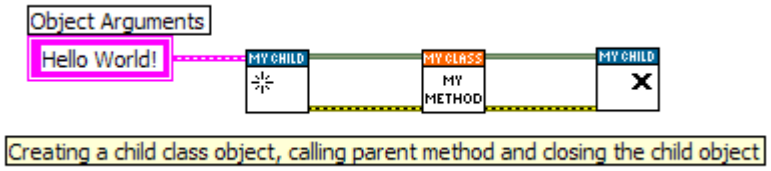
Autres outils dédiés à l'architecture



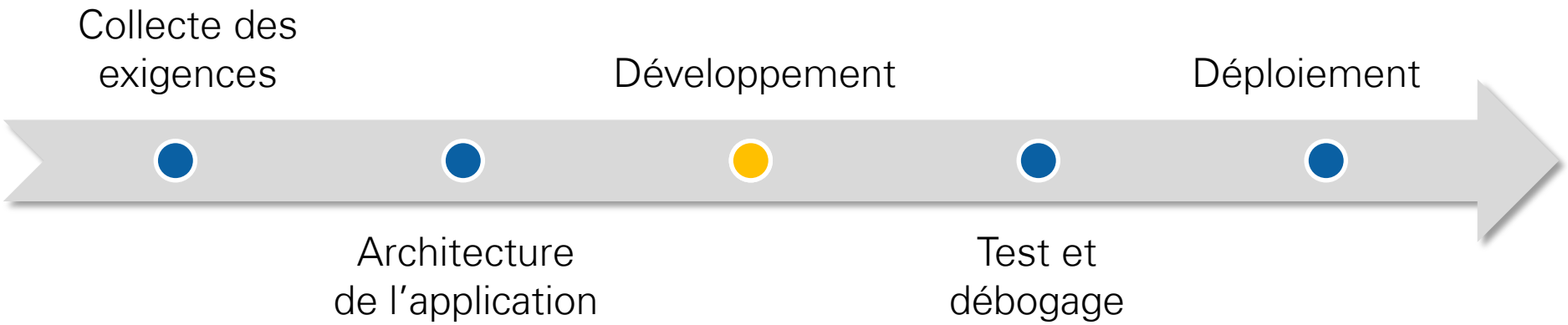
Multicoeur



LabVIEW Statechart



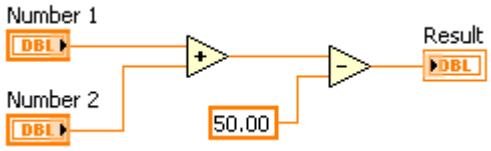
Programmation Orientée Objet (POO)



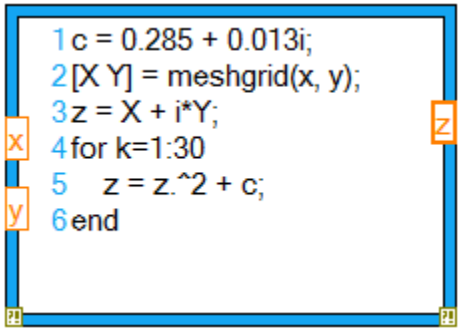
Buts

- Implémenter l'application en relation directe avec les spécifications
- Se conformer aux directives du modèle
- Effectuer des revues du code à chaque étape
- **Documenter, documenter, documenter**

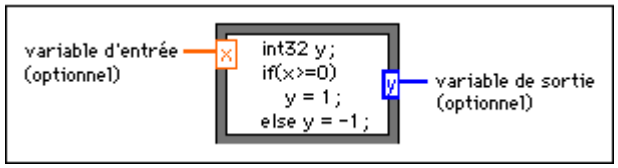
Plusieurs approches possibles



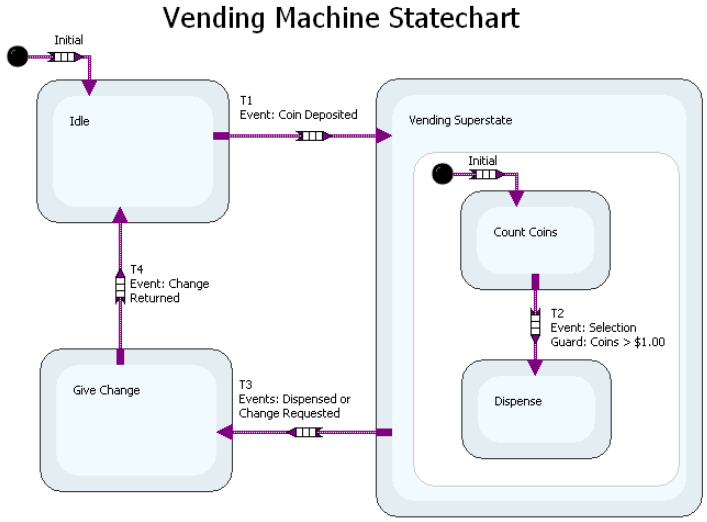
Flux de données



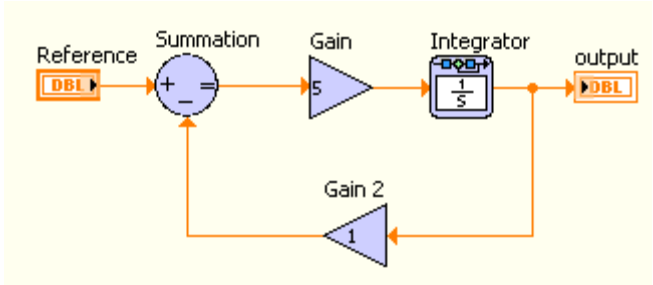
Mathématiques textuelles



Code C, VHDL



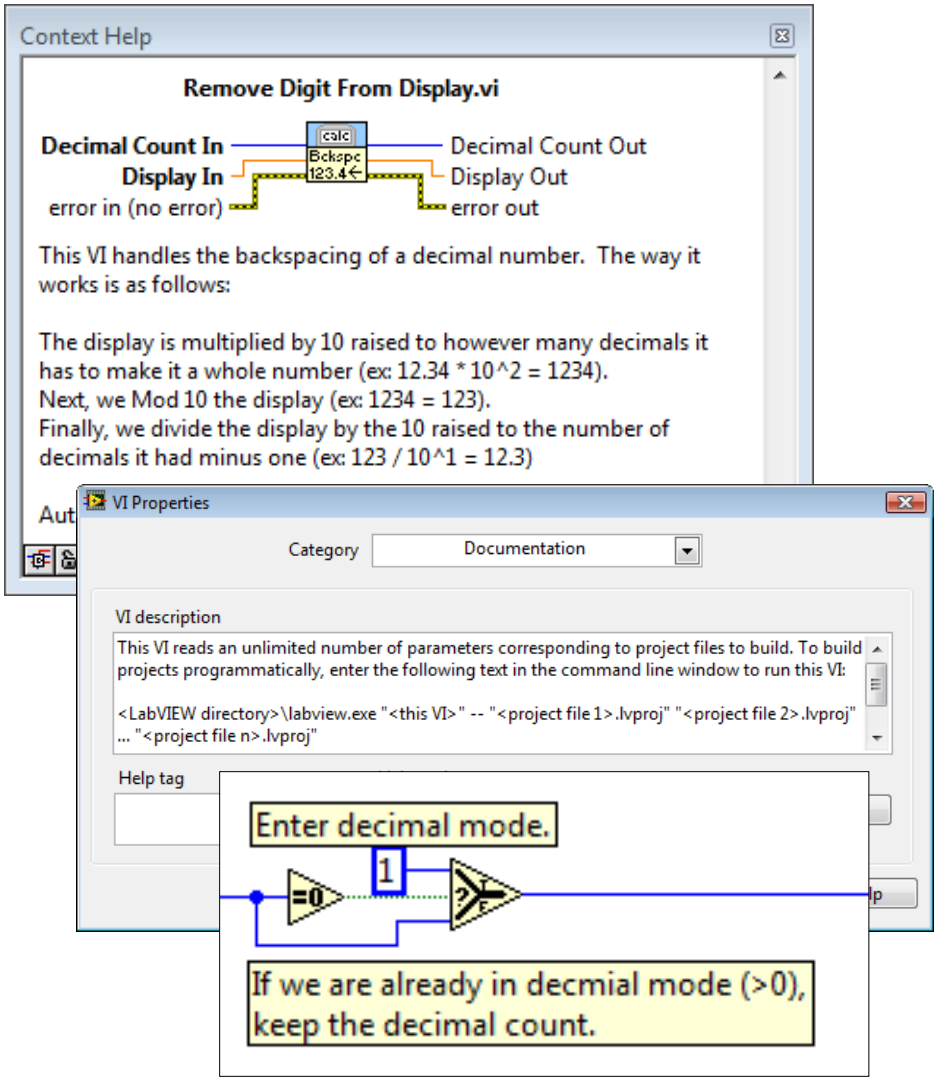
Machine à états



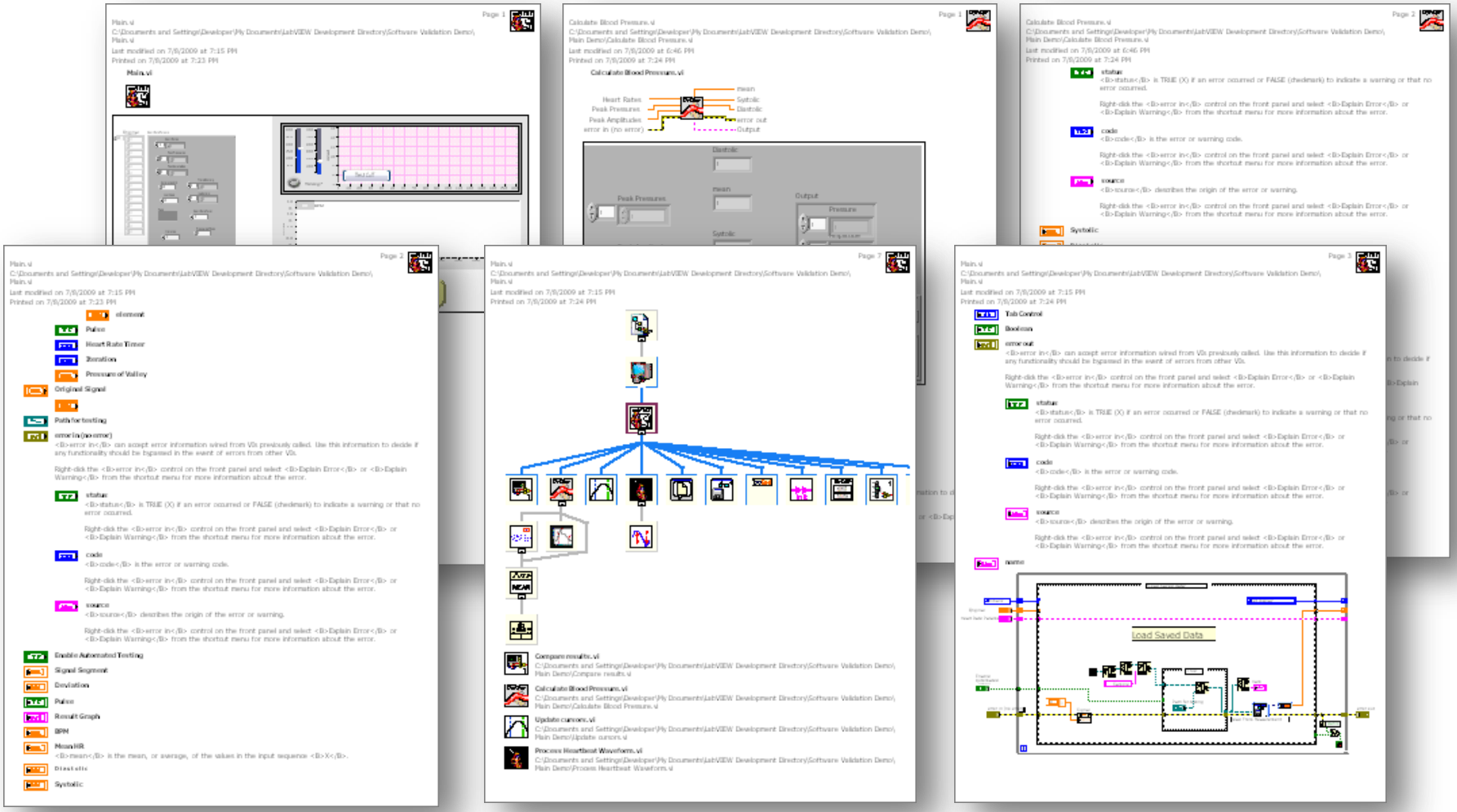
Simulation

Documentation

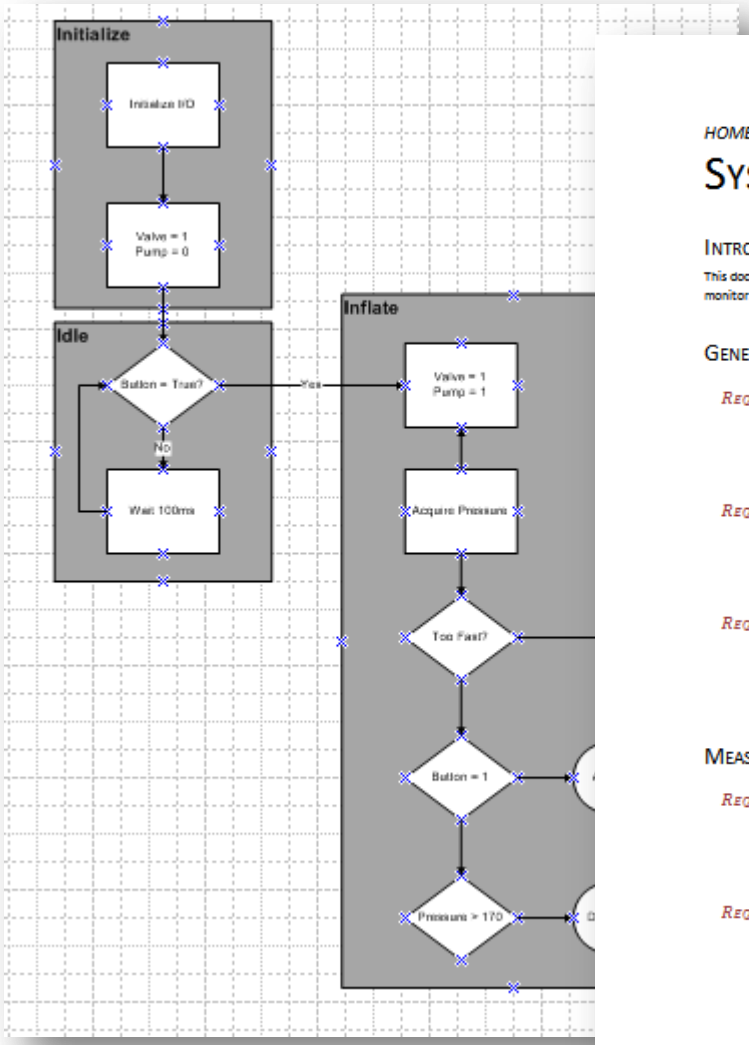
- Étiqueter les objets
- Commentaires en ligne
- Distinguer les icônes
- Description et astuces
- Impressions HTML
- Couverture des exigences



Documentation générée par LabVIEW



Documentation générée par LabVIEW



HOME NON-INVASIVE BLOOD PRESS

SYSTEM LEVEL RE

INTRODUCTION

This document contains the system level requi
monitor.

GENERAL SYSTEM REQUIREMENTS

REQ1: MEASURES BLOOD PRESSURE

The device measures and systolic and d
method.

Priority: High

REQ2: MEASURES HEART RATE

The device should be able to measure t
beats per minute

Priority: Medium

REQ3: HOME USE

This device should be able to be operat
to administer the test themselves and

Priority: High

MEASUREMENT REQUIREMENTS

REQ4: RESOLUTION OF BLOOD PRESSUR

The device should be able to detect a d
the entire range of the device.

Priority: High

REQ5: RESOLUTION OF HEART RATE M

The device should be able to detect a d
entire range of the device.

HOME NON-INVASIVE BLOOD PRESSURE (NIBP) MONITOR

VISION AND SCOPE

INTRODUCTION

This document contains the scope and vision associated with the blood pressure monitor.

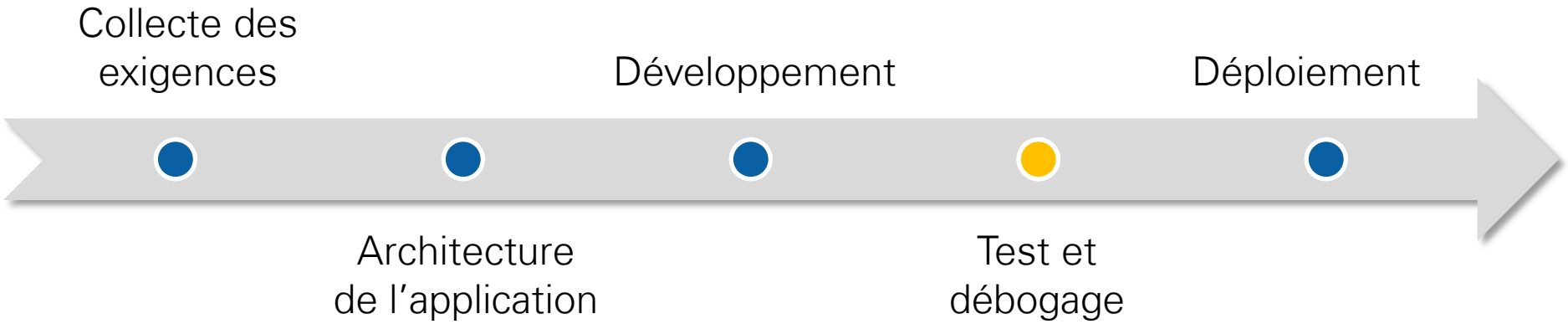
VISION

Monitoring your blood pressure at home offers several benefits. It can:

- **Help track treatment.** Self-monitoring provides vital information between visits to the doctor.
- **Encourage better control.** Taking your own blood pressure measurements has been shown to result in better blood pressure control and greater success meeting blood pressure targets.
- **Cut health care costs.** Home monitoring should cut down on the number of doctor visits.
- **Guard against white-coat hypertension.** Monitoring blood pressure at home or work can help determine if you have true high blood pressure or anxiety about the doctor.

SCOPE

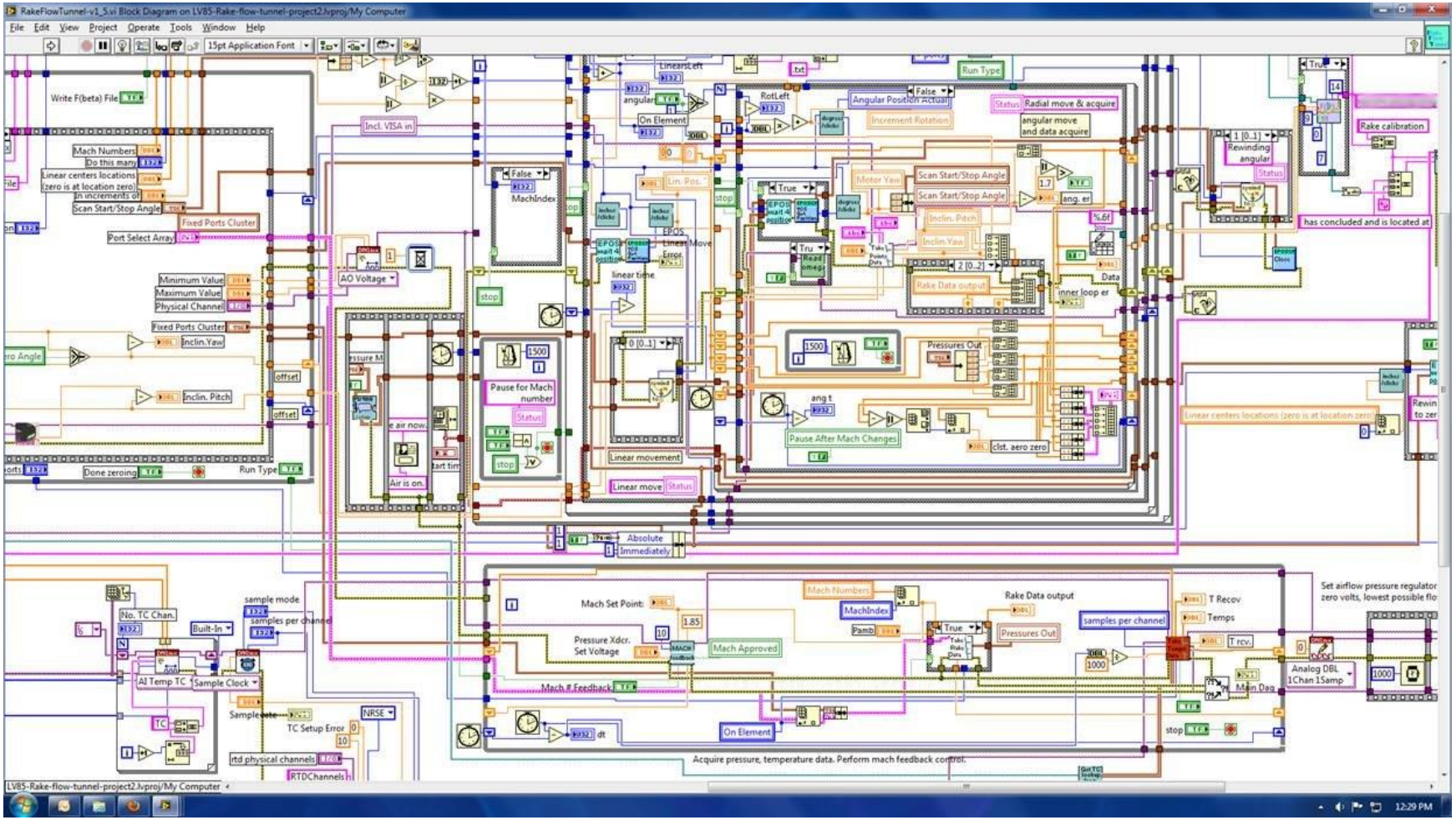
This device will provide a safe, affordable, and accurate means for a patient to monitor his/her own blood pressure and heart rate using an arm cuff and the oscillometric measurement method. Measurements will be targeted at less than a minute (on average) and the device must be simple enough for a patient to administer themselves without formal training. This device will be targeted at adults without irregular heartbeats.



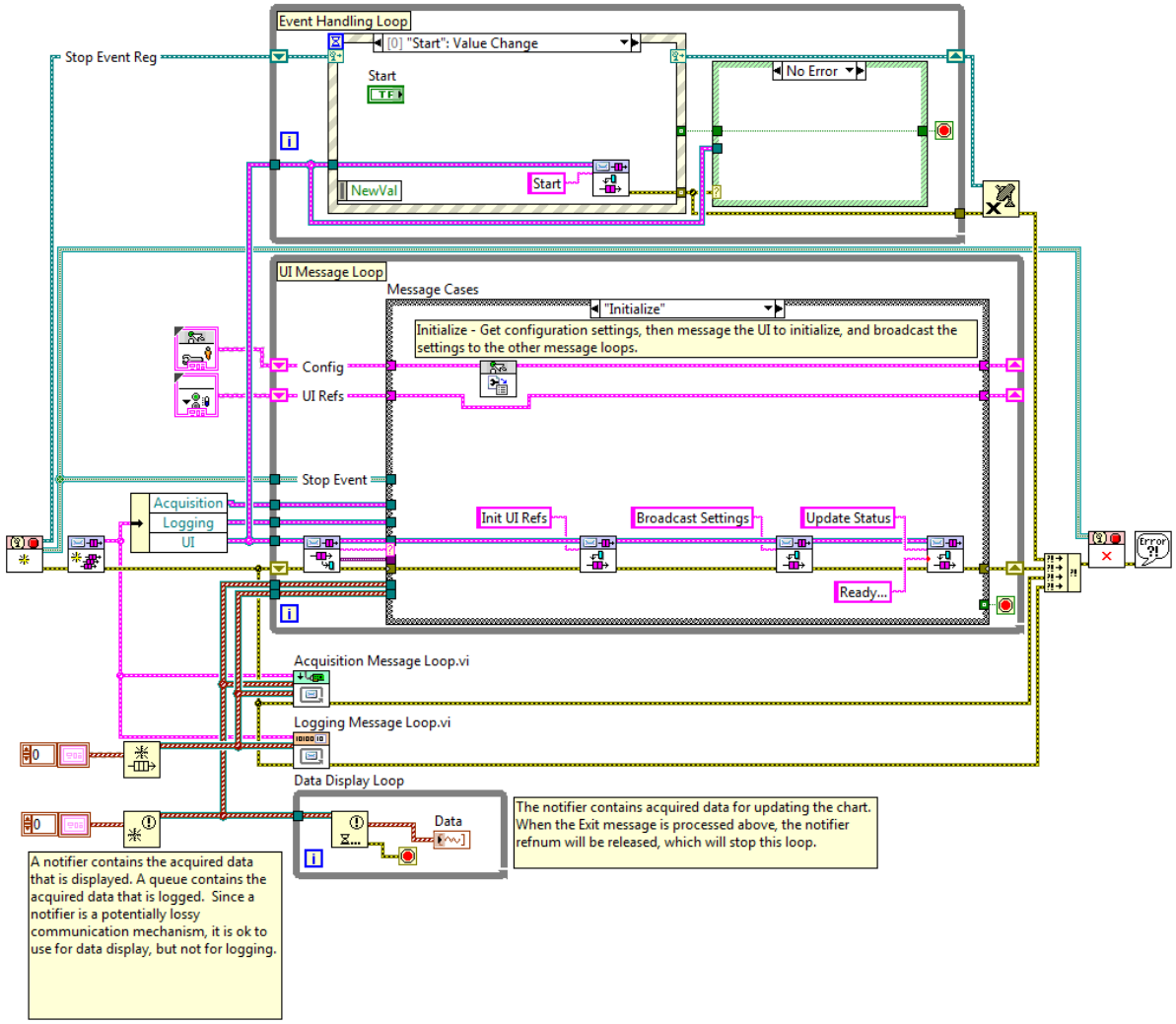
Outils d'analyse, de débogage et de validation du code

NATIONAL INSTRUMENTS

Comment reconnaissez-vous un bon codage ?

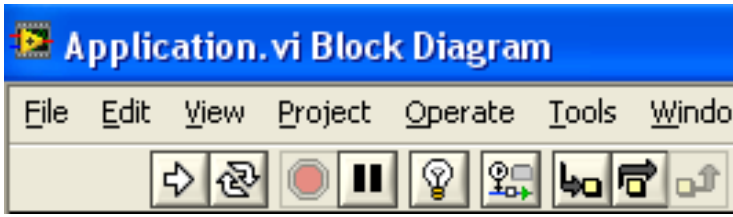


Comment reconnaissez-vous un bon codage ?



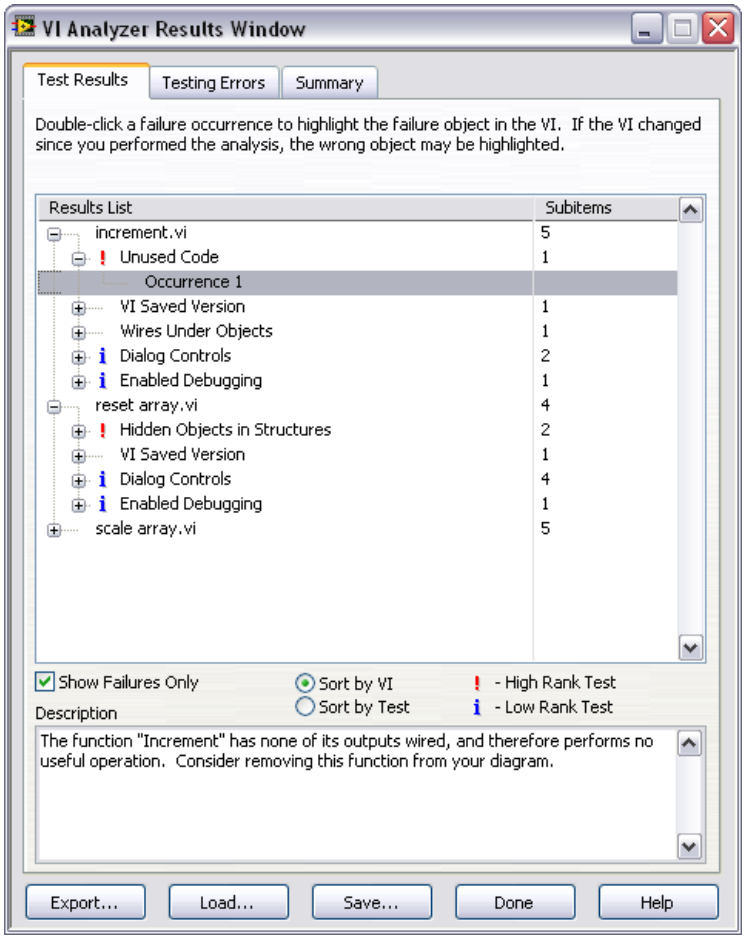
Outils directement intégré dans LabVIEW

- Compilation en arrière-plan
- Exécution pas-à-pas
- Gestionnaire de points d'arrêt
- Gestion d'erreurs automatique
- Nettoyage du diagramme
- Analyseur de VI
- Points de coercition (optimisation mémoire)
- Structures à désactivation conditionnelles

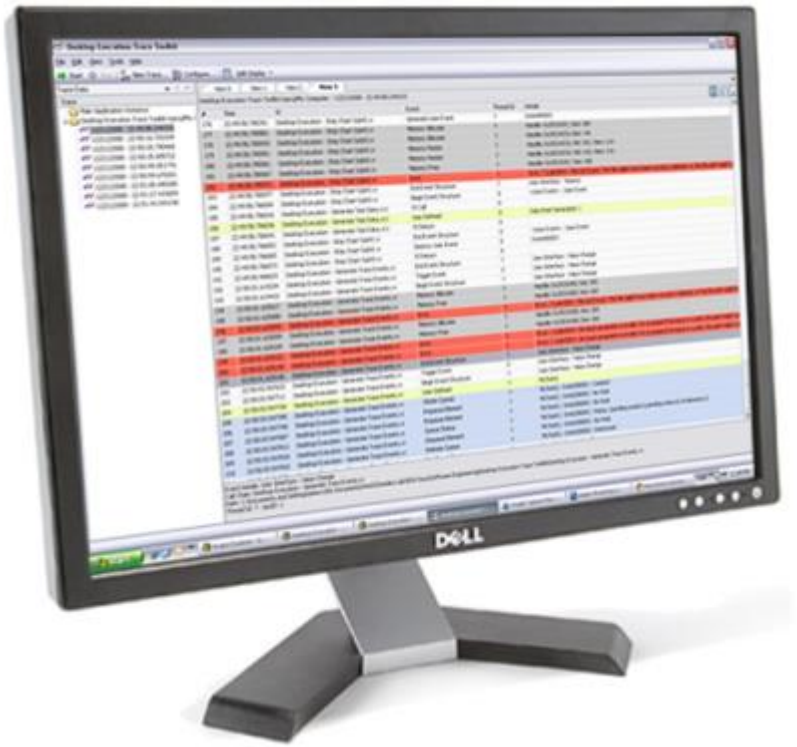


Outils » Analyseur de VI

- Automatiser l'analyse du code avec plus de 60 tests configurables
  - Performances
  - Style
- Inspecter interactivement les améliorations possibles
- Générer des rapports personnalisés
- Mesurer la complexité cyclomatique du code

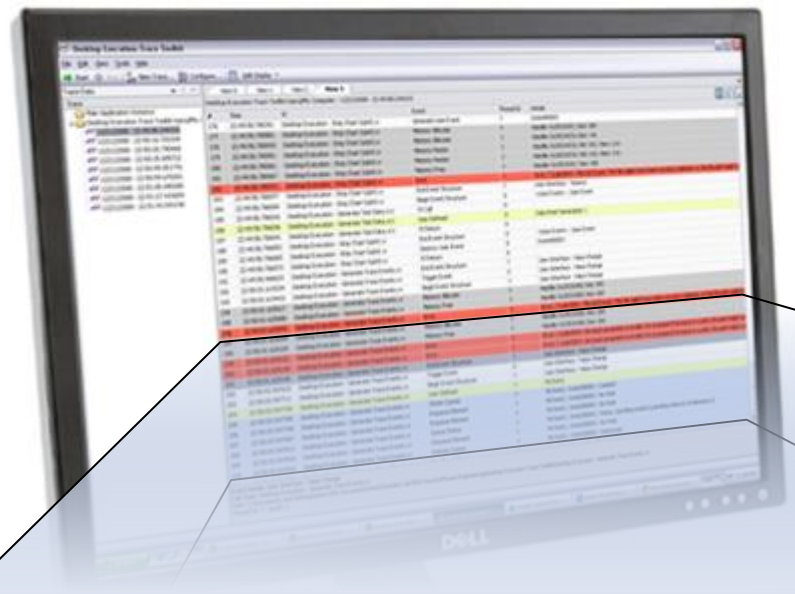


Toolkit Desktop Execution Trace



- Structures Événements
- Allocations mémoire
- Files/Notificateurs
- Pertes de références
- Identification des threads
- Erreurs non gérées
- Sous-VIs dynamiques et statiques
- Chaînes d'événements définies par l'utilisateur

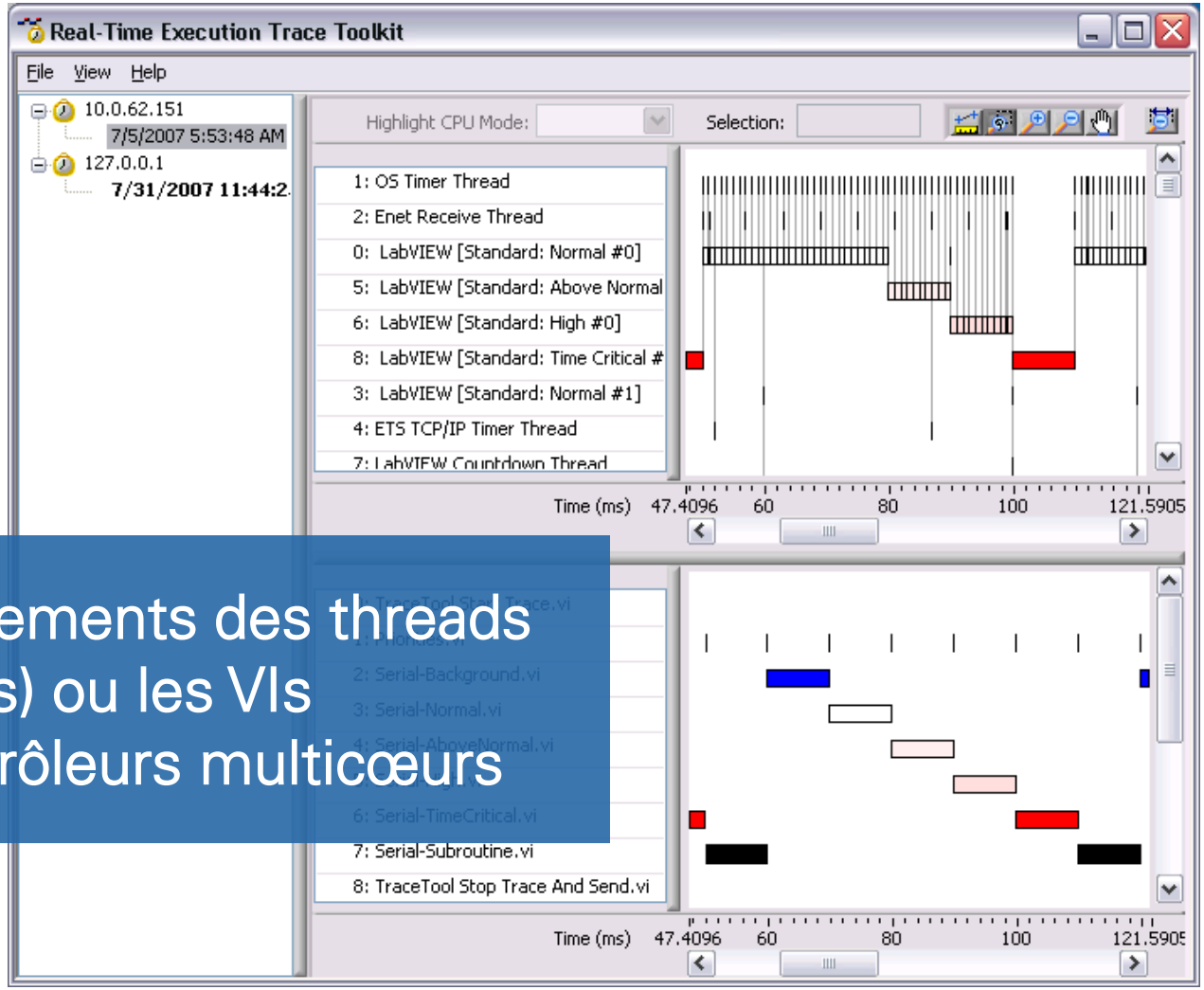
Toolkit Desktop Execution Trace



- Structures Événements
- Allocations mémoire
- Files/Notificateurs
- Pertes de références
- Identification des threads
- Erreurs non gérées
- Sous-VIs dynamiques et

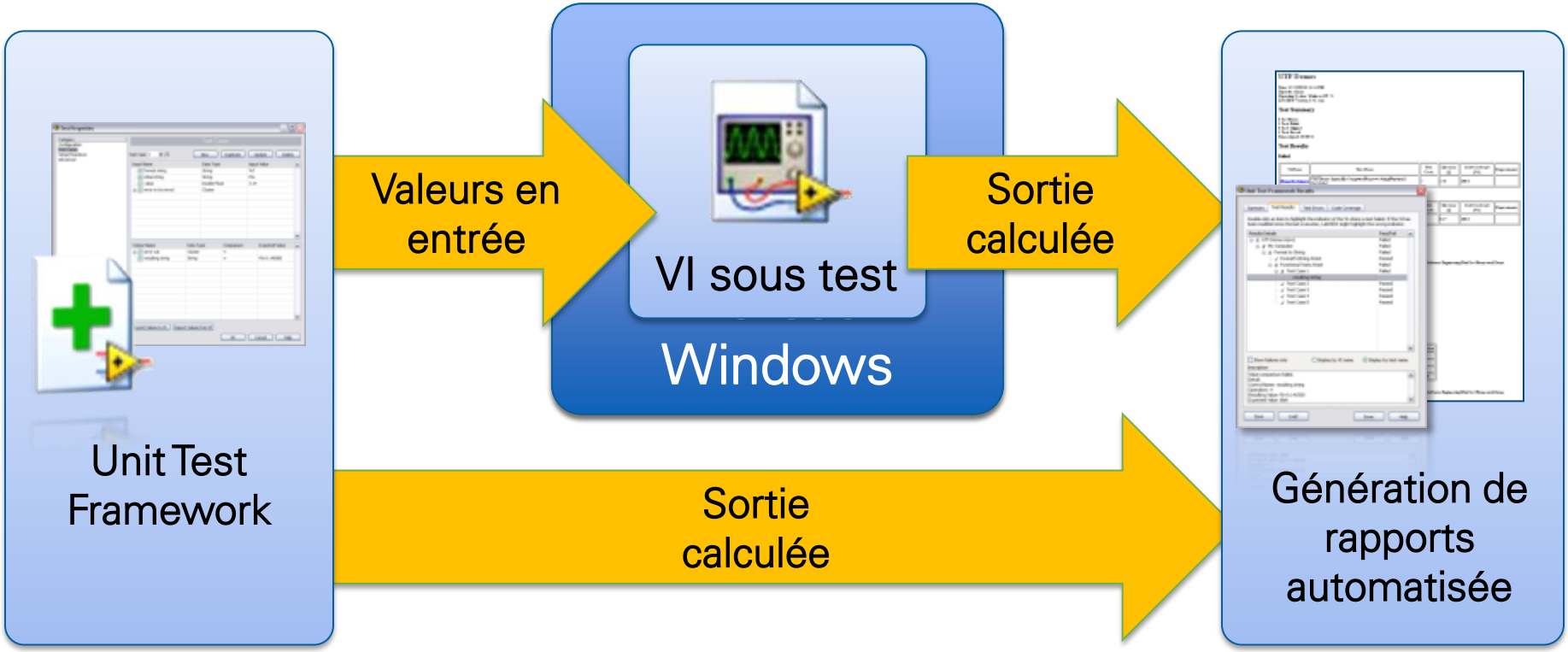
Strip Chart SubVI.vi	Memory Resize	7	Handle: 0x25CA3C8; Old: 142; New: 118
Strip Chart SubVI.vi	Memory Allocate	7	Handle: 0x25CA3C8; Size: 142
Strip Chart SubVI.vi	Memory Resize	7	Handle: 0x25CA3C8; Old: 142; New: 118
Strip Chart SubVI.vi	Error	7	Error: 7 (LabVIEW: File not found. The file might have
Generate Trace Events.vi	User Defined	7	MyTestQ
Generate Trace Events.vi	Obtain Queue	7	MyTestQ - 0x66200002 : Created
Generate Trace Events.vi	Enqueue Element	7	MyTestQ - 0x66200002 : No Wait

Toolkit Real-Time Execution Trace



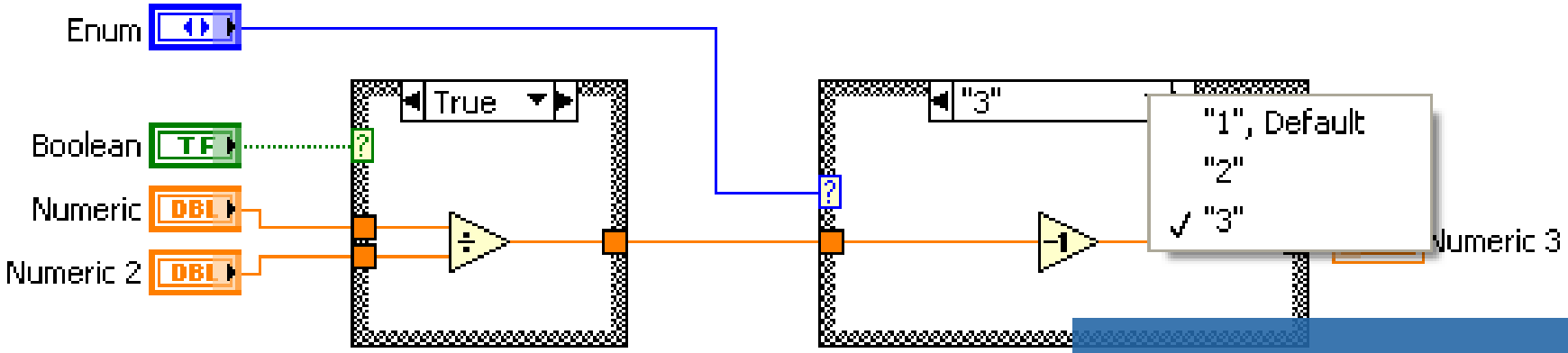
- Vérifie les cadencements des threads (boucles cadencées) ou les VIs
- Supporte les contrôleurs multicœurs

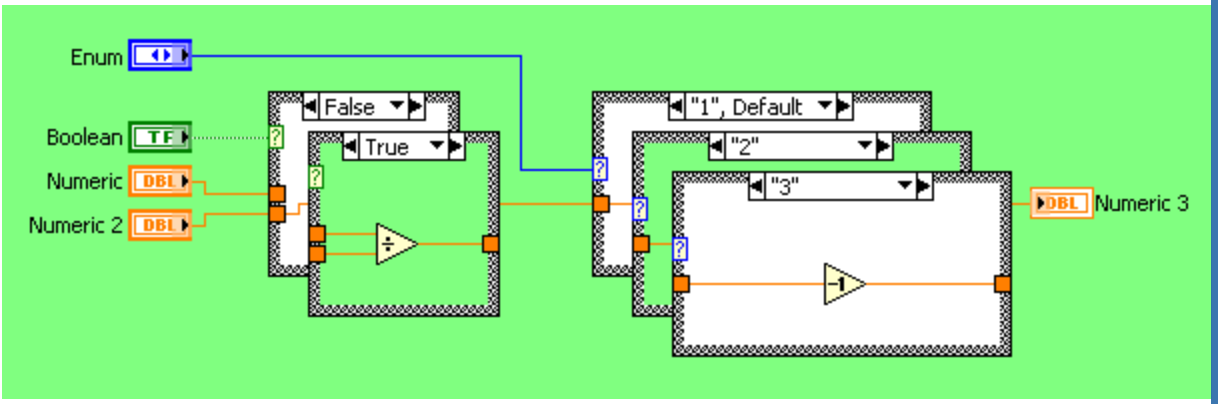
LabVIEW Unit Test Framework



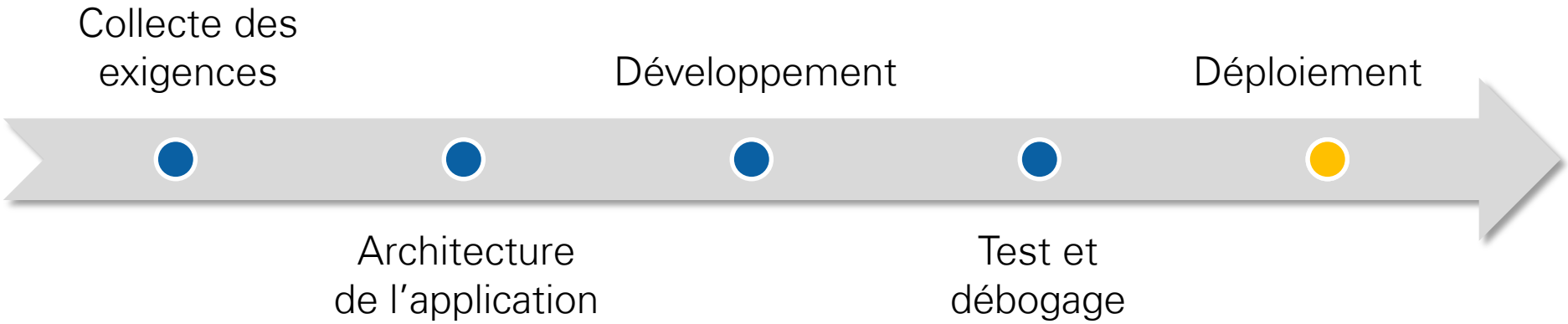
Vecteur de test = valeur(s) d'entrée + sortie(s) attendue(s)

Rapport de couverture du code





6 diagrammes possibles,
3 diagrammes exécutés
=> 50% de couverture du code



Outils de déploiement

Collecte des exigences

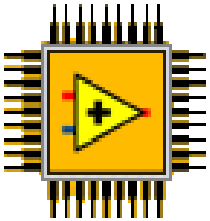
Architecture de l'application

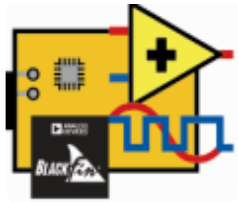
Développement

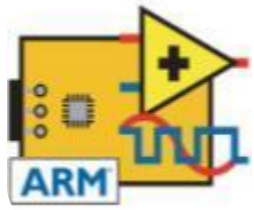
Test et débogage

Déploiement

Déployer du logiciel sur des cibles matérielles embarquées

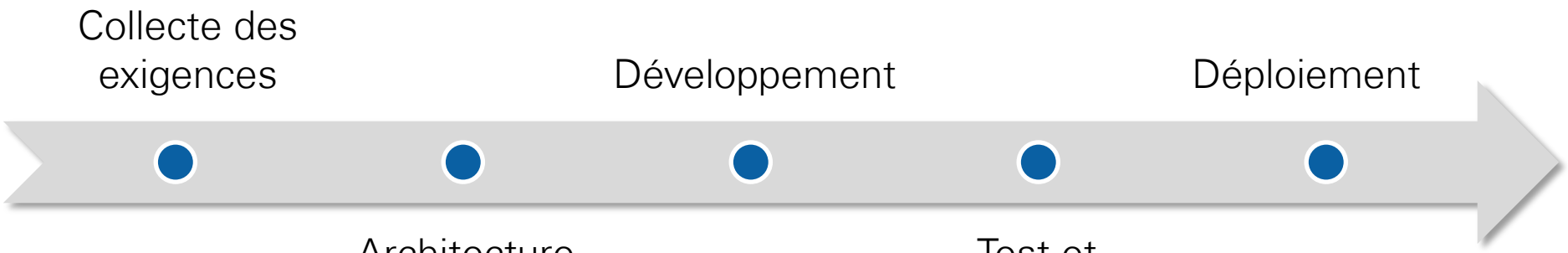




Construire des applications professionnelles pour PC de bureau



Le processus de génie logiciel



Architecture de l'application

Test et débogage

- NI Requirements Gateway
- Modèles de conception
- Orienté objet
- Multicœur
- Flux de données
- MathScript
- Statechart
- Simulation
- Express
- VI Analyzer
- Real Time Execution Trace
- Desktop Execution Trace
- Unit Test Framework
- Application Builder
- Real-Time
- FPGA
- Embarqué

Formation et certifications

- Formations au catalogue, chez nous ou sur site
  - LabVIEW Core 3
  - Object-Oriented Design and Programming in LabVIEW
  - Managing Software Engineering in LabVIEW
  - Advanced Architectures in LabVIEW

- Certifications
  - **Certified LabVIEW Associate Developer (CLAD)** : connaît et maîtrise les bases de LabVIEW
  - **Certified LabVIEW Developer (CLD)** : familier avec l'usage des modèles de programmation
  - **Certified LabVIEW Architect (CLA)** : capable d'architecturer un code et de coordonner une importante équipe de développement

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