Qt Essentials - Application Creation Module

Qt Essentials - Training Course

Produced by Nokia, Qt Development Frameworks

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http://qt.nokia.com

Module: Application Creation

- Main Windows
- Settings
- Resources
- Translation for Developers
- Deploying Qt Applications

Module Objectives

We will create an application to show fundamental concepts

- **Main Window:** How a typical main window is structured
- **Settings:** Store/Restore application settings
- **Resources:** Adding icons and other files to your application
- **Translation:** Short overview of internationalization
- **Deployment:** Distributing your application

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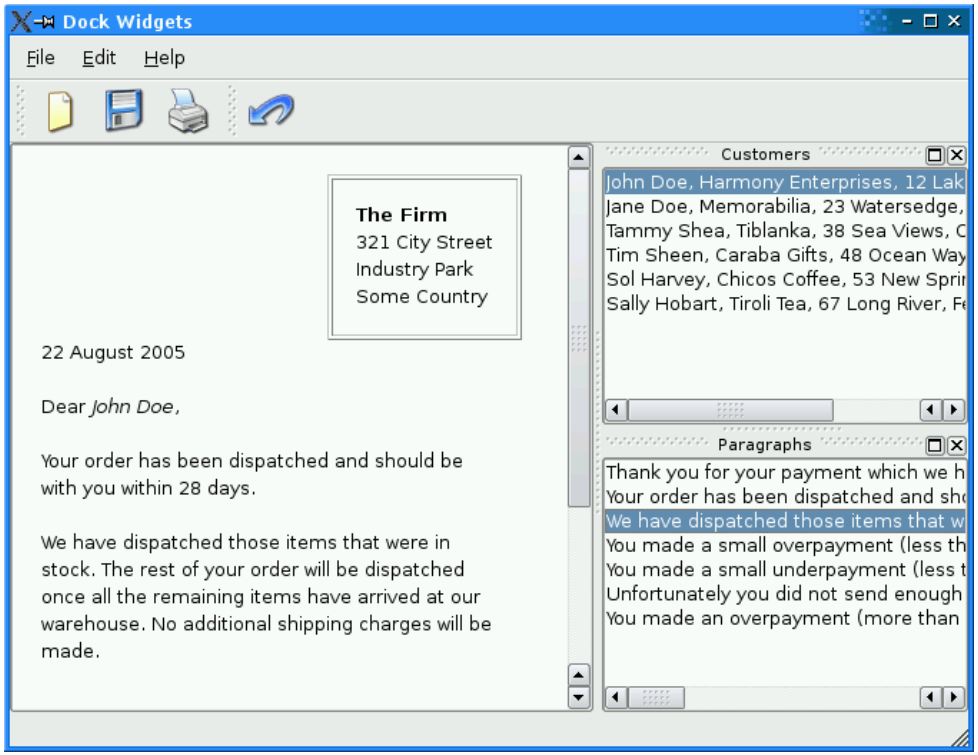
Typical Application Ingredients

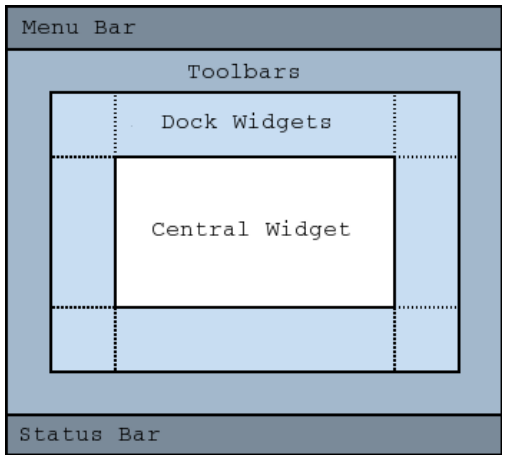
- Main window with
  - Menu bar
  - Tool bar, Status bar
  - Central widget
  - Often a dock window
- Settings (saving state)
- Resources (e.g icons)
- Translation
- Load/Save documents

Not a complete list



Main Window

- `QMainWindow`: main application window
- Has own layout
  - Central Widget
  - QMenuBar
  - QToolBar
  - QDockWidget
  - QStatusBar



- Central Widget
  - **`QMainWindow`**`::setCentralWidget( widget )`
  - Just any widget object

Creating Actions - QAction

- *Action is an abstract user interface command*
- Emits signal triggered on execution
  - Connected slot performs action
- Added to menus, toolbar, key shortcuts
- Each performs same way
  - Regardless of user interface used

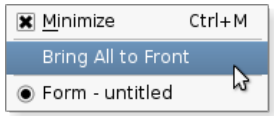
```
void MainWindow::setupActions() {
  QAction* action = new QAction(tr("Open ..."), this);
  action->setIcon(QIcon(":/images/open.png"));
  action->setShortcut(QKeySequence::Open);
  action->setStatusTip(tr("Open file"));
  connect(action, SIGNAL(triggered()), this, SLOT(onOpen()));

  menu->addAction(action);
  toolbar->addAction(action);
```

QAction capabilities

- `setEnabled(bool)`
  - Enables disables actions
  - In menu and toolbars, etc...
- `setCheckable(bool)`
  - Switches checkable state (on/off)
  - `setChecked(bool)` toggles checked state
- `setData(QVariant)`
  - Stores data with the action
- See QAction Documentation

Create Menu Bar

- **QMenuBar**: a horizontal menu bar
- **QMenu**: represents a menu
  - indicates action state
- **QAction**: menu items added to **QMenu**




```
void MainWindow::setupMenuBar() {
  QMenuBar* bar = menuBar();
  QMenu* menu = bar->addMenu(tr("&File"));
  menu->addAction(action);
  menu->addSeparator();

  QMenu* subMenu = menu->addMenu(tr("Sub Menu"));
  ...
```

Creating Toolbars - QToolBar

- Movable panel ...
  - Contains set of controls
  - Can be horizontal or vertical
- QMainWindow::addToolbar(toolbar)
  - Adds toolbar to main window
- QMainWindow::addToolBarBreak()
  - Adds section splitter
- QToolBar::addAction(action)
  - Adds action to toolbar
- QToolBar::addWidget(widget)
  - Adds widget to toolbar

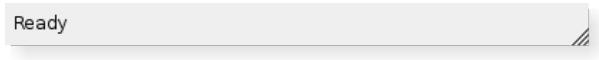
```
void MainWindow::setupToolBar() {
  QToolBar* bar = addToolBar(tr("File"));
  bar->addAction(action);
  bar->addSeparator();
  bar->addWidget(new QLineEdit(tr("Find ...")));
  ...
```

QToolButton

- Quick-access button to commands or options
- Used when adding action to QToolBar
- Can be used instead `QPushButton`
  - Different visual appearance!
- Advantage: allows to attach action

```
QToolButton* button = new QToolButton(this);
button->setDefaultAction(action);
// Can have a menu
button->setMenu(menu);
// Shows menu indicator on  button
button->setPopupMode(QToolButton::MenuButtonPopup);
// Control over text + icon placements
button->setToolButtonStyle(Qt::ToolButtonTextUnderIcon);
```

The Status Bar - QStatusBar



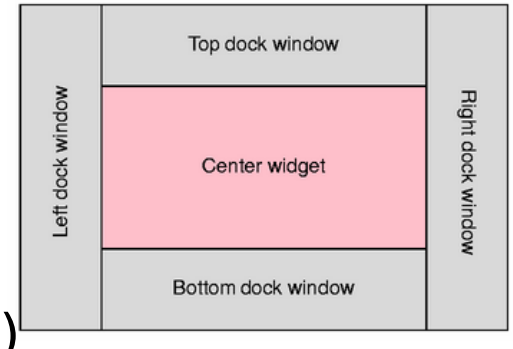
- Horizontal bar
  Suitable for presenting status information

- `showMessage( message, timeout )`
  - Displays temporary message for specified milli-seconds
- `clearMessage()`
  - Removes any temporary message
- `addWidget()` or `addPermanentWidget()`
  - Normal, permanent messages displayed by widget

```
void MainWindow::createStatusBar() {
  QStatusBar* bar = statusBar();
  bar->showMessage(tr("Ready"));
  bar->addWidget(new QLabel(tr("Label on StatusBar")));
```

Creating Dock Windows - `QDockWidget`

- Window docked into main window



- `Qt::DockWidgetArea` enum
  - Left, Right, Top, Bottom dock areas
- `QMainWindow::setCorner(corner,area)`
  - Sets area to occupy specified corner
- `QMainWindow::setDockOptions(options)`
  - Specifies docking behavior (animated, nested, tabbed, ...)

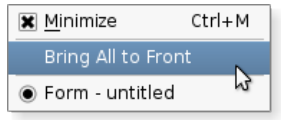
```
void MainWindow::createDockWidget() {
  QDockWidget *dock = new QDockWidget(tr("Title"), this);
  dock->setAllowedAreas(Qt::LeftDockWidgetArea);
  QListWidget *widget = new QListWidget(dock);
  dock->setWidget(widget);
  addDockWidget(Qt::LeftDockWidgetArea, dock);
```

QMenu and Context Menus

- Launch via event handler

```
void MyWidget::contextMenuEvent(event) {
 m_contextMenu->exec(event->globalPos());
```

- or signal `customContextMenuRequested()`
  - Connect to signal to show context menu
- Or via `QWidget::actions()` list
  - `QWidget::addAction(action)`
  - `setContextMenuPolicy(Qt::ActionsContextMenu)`
  - Displays `QWidget::actions()` as context menu



Typical APIs

- QWidget
  - setWindowModified(...)
  - setWindowTitle(...)
  - addAction(...)
  - contextMenuEvent(...)
- QMainWindow
  - setCentralWidget(...)
  - menuBar()
  - statusBar()
  - addToolbar(...)
  - addToolBarBreak()
  - addDockWidget(...)
  - setCorner(...)
  - setDockOptions(...)
- QAction
  - setShortcuts(...)
  - setStatusTip(...)
  - signal triggered()
- QMenuBar
  - addMenu(...)
- QToolbar
  - addAction(...)
- QStatusBar
  - showMessage(...)
  - clearMessage()
  - addWidget(...)

Lab: *Text Editor*

- Create a text editor with
  - *load*, *save*, *quit*
  - *about* and *About Qt*
- A `QPlainTextEdit` serves for editing the text.
- Optional:
  - Show whether the file is dirty
  - Ask the user whether to save if file is dirty when application quits
  - Make sure also to asks when window is closed via window manager
  - Show the cursor position in the status bar
    - Position is determined by cursors block and column count
  - Add printing support. See Printing with Qt Documentation

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Persistent Settings - QSettings

- Configure QSettings

```
QCoreApplication::setOrganizationName("MyCompany");
QCoreApplication::setOrganizationDomain("mycompany.com");
QCoreApplication::setApplicationName("My Application");
```

- Typical usage

```
QSettings settings;
settings.setValue("group/value", 68);
int value = settings.value("group/value").toInt();
```

- Values are stored as QVariant
- Keys form hierarchies using '/'
  - or use beginGroup(prefix) / endGroup()
- value() excepts default value
  - settings.value("group/value", 68).toInt()
- If value not found and default not specified
  - Invalid QVariant() returned

Restoring State of an Application

- Store geometry of application

```
void MainWindow::writeSettings() {
  QSettings settings;
  settings.setValue("MainWindow/size", size());
  settings.setValue("MainWindow/pos", pos());
}
```

- Restore geometry of application

```
void MainWindow::readSettings() {
  QSettings settings;
  settings.beginGroup("MainWindow");
  resize(settings.value("size", QSize(400, 400)).toSize());
  move(settings.value("pos", QPoint(200, 200)).toPoint());
  settings.endGroup();
}
```

Settings - Behind the Scenes

- Stored in platform specific format
  - Unix: INI files
  - Windows: System registry
  - MacOS: CFPreferences API
  - See Platform-Specific Notes Documentation
- *Value lookup will search several locations*
  1. User-specific location
     1. for application
     2. for applications by organization
  2. System-wide location
     1. for application
     2. for applications by organization
- See Fallback Mechanism Documentation
- `QSettings` creation is cheap! Use on stack

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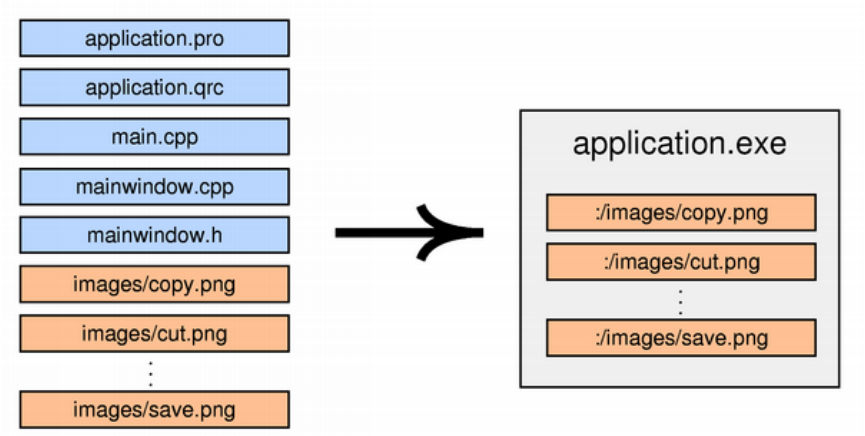
Resource System

- Platform-independent mechanism for storing binary files
  - Not limited to images
- Resource files stored in application's executable
- Useful if application requires files
  - E.g. icons, translation files, sounds
  - Don't risk of losing files, easier deployment



See The Qt Resource System Documentation

Using Resources

- Resources specified in .qrc file

```
<!DOCTYPE RCC><RCC version="1.0">
<qresource>
  <file>images/copy.png</file>
  <file>images/cut.png</file>
  ...
</qresource>
</RCC>
```

  - Can be created using QtCreator
- Resources are accessible with ':' prefix
  - Example: ":/images/cut.png"
  - Simply use resource path instead of file name
  - `QIcon(":/images/cut.png")`
- To compile resource, edit .pro file
  - `RESOURCES += application.qrc`
  - qmake produces make rules to generate binary file

Resource Specifics

- Path Prefix
  - `<qresource prefix="/myresources">`
  - File accessible via `":/myresources/..."`
- Aliases
  - `<file alias="cut">images/cut.png</file>`
  - File accessible via `":/cut"`
- Static Libraries and Resources
  - Need to force initialization
  - `Q_INIT_RESOURCE(basename);`
- Loading resources at runtime
  - Use rcc to create binary and register resource
  - `rcc -binary data.qrc -o data.rcc`
  - `QResource::registerResource("data.rcc")`
- Traverse resource tree using `QDir(":/")`

Lab: Upgrade editor to use resources

- Use your previous editor, to use Qt resource system for icons
- Tip: You can use Qt Creator to create QRC files

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Internationalization (i18n)

- **This is by no means a complete guide!**
- Internationalization (i18n)
  - Designing applications to be adaptable to languages and regions without engineering changes.
- Localization (I10n)
  - Adapting applications for region by adding components and translations
- Qt supports the whole process:
  - QString supports unicode
  - On-screen texts (`QObject::tr()`)
  - Number and date formats (`QLocale`)
  - Icons loading (Resource System)
  - Translation tool (Qt Linguist)
  - LTR and RTL text, layout and widgets (e.g. arabic)
  - Plural handling (1 file vs 2 files)
- See Internationalization with Qt Documentation

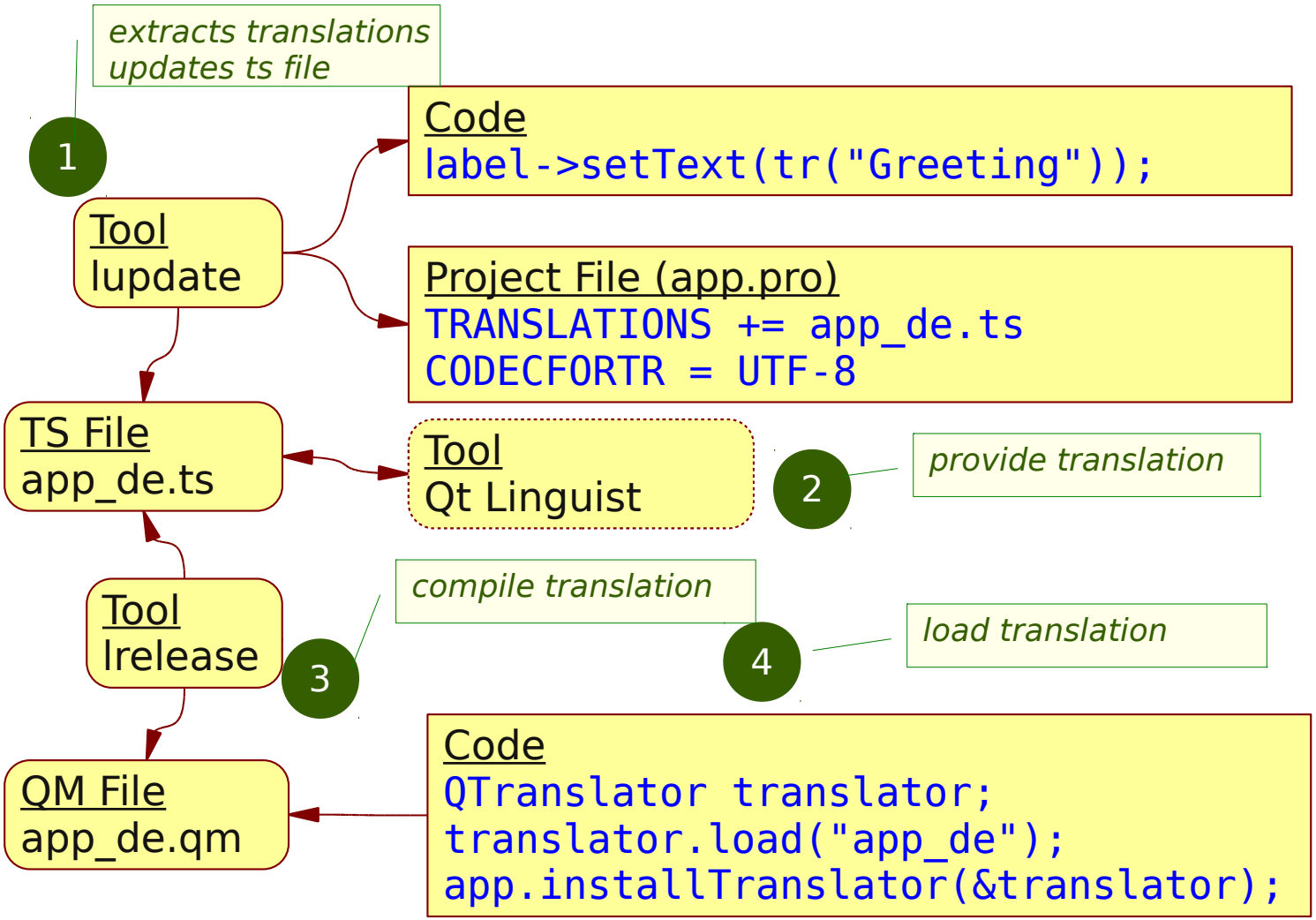
Text Translation

- **lupdate** - scan C++ and .ui files for strings. Create/update .ts file
- **linguist** - edit .ts file for adding translations
- **lrelease** - read .ts and creates .qm file for release.
- **QObject::tr()** - mark translatable strings in C++ code.
  - combine with `QString::arg()` for dynamic text

```
void MyWidget::someFunction(QString name, QDate d) {
 //: This comment is seen by translation staff
 label->setText(tr("Name: %1  Date: %2")
                .arg(name).arg(d.toString()));
 setWindowTitle(tr("File: %1 Line: %2 [*]").arg(f).arg(l));
 // ...
```

- See Writing Source Code for Translation Documentation

Translation Process



Other Internationalization

- Qt classes are locale aware
- Numbers

```
QLocale::setDefault(QLocale::German); // de_DE
QLocale german; bool ok;
german.toDouble("1234,56", &ok); // ok == true
QLocale::setDefault(QLocale::C); // en_US
value = QString("1234.56").toDouble(&ok) // ok == true
```

- `QDate`, `QTime` and `QDateTime`

```
qDebug() << QDate().toString();  // prints localized date
```

  - See QDate Documentation
- Translating Media (Resource System)
  - See See Qt Resource System Documentation
- Use `QKeySequence` for Accelerator Values

```
menu->setShortCuts(QKeySequence::New);
menu->setShortCuts(QKeySequence(tr("Ctrl+N")));
```

Lab: Translate Editor to German

- We use our existing editor
- In the handout you will find a list of translation words
- Germany country code is de
- Tip: You can use Qt Linguist to edit translations

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Ways of Deploying

- Static Linking
  - Results in stand-alone executable
  - + Only few files to deploy
  - − Executables are large
  - − No flexibility
  - − You cannot deploy plugins
- Shared Libraries
  - + Can deploy plugins
  - + Qt libs shared between applications
  - + Smaller, more flexible executables
  - − More files to deploy
- Qt is by default compiled as shared library
- If Qt is pre-installed on system
  - Use shared libraries approach
- See Deploying Qt Applications Documentation

Deployment

- Shared Library Version
  - If Qt is not a system library
    - Need to redistribute Qt libs with application
  - Minimal deployment
    - Libraries used by application
    - Plugins used by Qt
  - Ensure Qt libraries use correct path to find Qt plugins

    See Using qt.conf Documentation
- Static Linkage Version
  - Build Qt statically
    - `$QTDIR/configure -static <your other options>`
    - Specify required options (e.g. sql drivers)
  - Link application against Qt
  - Check that application runs stand-alone
    - Copy application to machine without Qt and run it
- See Platform-Specific Notes Documentation