BlackBerry 10 Jam

Developing NFC Applications for BlackBerry 10

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DEV120

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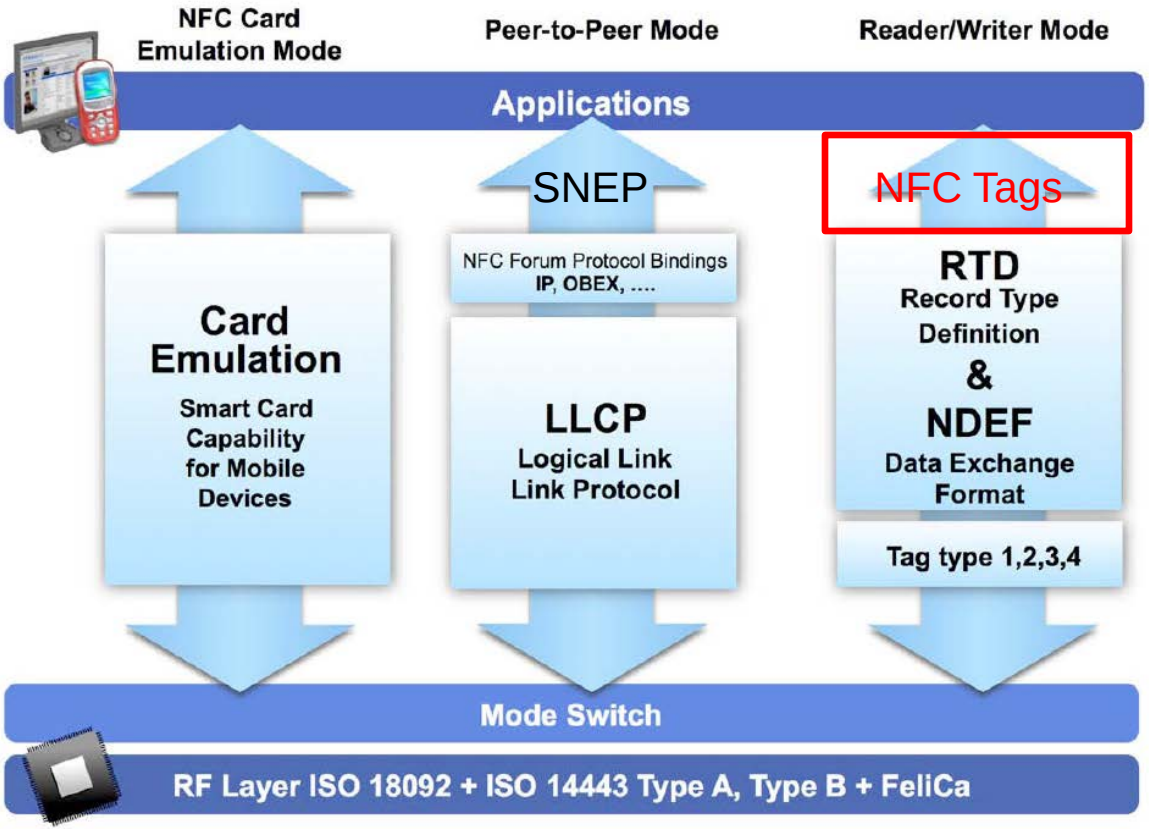
Session Overview

BlackBerry 10 Jam

- Introductions
- Brief introduction to NFC
- Developing for the BlackBerry® 10 platform
- How to read NFC Tags
- How to write to NFC tags
- Close
- Q&A

NFC Forum Architecture



- We're going to talk about:
  - Reading NFC Tags
  - Writing NFC tags
- And general BlackBerry 10 development using the NDK

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Developing for BlackBerry 10

Martin Woolley

Developing for BlackBerry 10

- NFC can be exploited on BlackBerry today

Java	WebWorks
Tag reading and writing	Tag reading using open source extension
Peer to peer including LLCP and SNEP	
Card Emulation using a choice of 2 Secure Elements	

- How many of you have used these APIs?

Developing for BlackBerry 10

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- Here's what we're going to talk about:
  - Developing NFC applications for the BlackBerry 10 platform
  - The BlackBerry NDK with Cascades and Qt
  - The BlackBerry Platform Services (BPS)

- Our discussion will be based around a real application "Tag Tool"

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Reading NFC Tags

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About NFC Tags

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- A card that stores data
- They come in many forms
- The NFC Forum define 4 types
- Simple and standardised behaviour
- Data is stored in the **NDEF** format
- It’s the standardisation that makes tags so useful

About NFC Tags

- Bus stops in Caen, France use NFC tags
- They provide easy access to bus arrival times
  - Browser opens at the transport company's web site and the next bus time is displayed
  - No special software from the bus company required
  - No extra infrastructure required at the bus stop

Developing your own tag reader

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- Initialise the BlackBerry Platform Services (BPS) library
- Request NFC events from the BPS
- Register for specific NDEF message types
- Process NFC event objects in an event loop

Initialise BPS

This step requires a single function call to a standard BPS library function:

```
#include <bps/bps.h>


int rc = bps_initialize();
```

Request NFC events from BPS

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This step also requires a single function call only:

```
#include <nfc.h>

rc = nfc_request_events();
```

Specific NDEF message types

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Here we register for three NDEF RTD types:

- **“U” (URI),**
- **“T” (Text) and**
- **“Sp” (Smart Poster).**

```
nfc_register_ndef_reader(NDEF_TNF_WELL_KNOWN, "U”);

nfc_register_ndef_reader(NDEF_TNF_WELL_KNOWN, "T”);

nfc_register_ndef_reader(NDEF_TNF_WELL_KNOWN, "Sp”);
```

The Event Loop

This code should execute in a separate thread from the main UI thread since it involves blocking calls.

```
while (notInterrupted()) {
  bps_event_t *event; int domain; int rc;
  // Blocking call to wait for events with a timeout.
  rc = bps_get_event(&event, BPS_EVENT_TIMEOUT); // BLOCKS
  if (!rc) {
    if (event) {
        handleNfcEvent(event);
.....
```

Handling an NFC Event Object (1)

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```
void NfcManager::handleNfcEvent(bps_event_t *event) {

    // get ndef target. Required to read ndef data.
    nfc_target_t* target;
    nfc_get_target(event, &target)

    // count the number of messages available
    int msg_count = 0;
    nfc_get_ndef_message_count(target, &msg_count);
```

Handling an NFC Event Object (2)

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```
// We only want the first NDEF message for the moment
if(msg_count > 0) {
    nfc_ndef_message_t *message;
    nfc_get_ndef_message(target, 0, &message);

// Check the number of NDEF records in this message
    int rec_count = 0;
    nfc_get_ndef_record_count(message, &rec_count);
```

Handling an NFC Event Object (3)

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```
// We only want the first NDEF record for the moment
if(rec_count > 0) {

// Get the first NDEF message record
   nfc_ndef_record_t *record;
   nfc_get_ndef_record(message, 0, &record);

// Get the record payload
   uchar_t* data;
   int len;
   nfc_get_ndef_record_payload(record, &data, &len);
```

Handling an NFC Event Object (4)

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```
// Obtain other attributes from the record
tnf_type_t *tnf;
nfc_get_ndef_record_tnf(record, &tnf);

char *type;
nfc_get_ndef_record_type(record, &type);

char *uri;
nfc_get_sp_uri(record, &uri)
```

Recap (1)

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```
// initialisation

int rc = bps_initialize();

rc = nfc_request_events();

nfc_register_ndef_reader(NDEF_TNF_WELL_KNOWN, "U");
```

Recap (2)

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```
// in the event loop

rc = bps_get_event(&event, BPS_EVENT_TIMEOUT); // BLOCKS
nfc_get_target(event, &target)
nfc_get_ndef_message(target, 0, &message);
nfc_get_ndef_record(message, 0, &record);

nfc_get_ndef_record_payload(record, &data, &len);
nfc_get_ndef_record_tnf(record, &tnf);
nfc_get_ndef_record_type(record, &type);
nfc_get_sp_uri(record, &uri)
```

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Sample Application Review #1

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BlackBerry 10 Development

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- There's more to developing an NFC application for the BlackBerry 10 platform than simply calling the NFC APIs
- Imagine what we could do with the NFC "Bus Stop" example?

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Flow

- User Experience
- Simplify consumption of real-time bus arrival data by simply tapping a poster

Share

- Imagine it’s a child taking the bus
- The NFC tag could trigger your app to share the child’s location/timestamp with the family BBM group

Extend

- Calculate expected time of arrival at destination and notify parent via BBM family group

BlackBerry 10 Development

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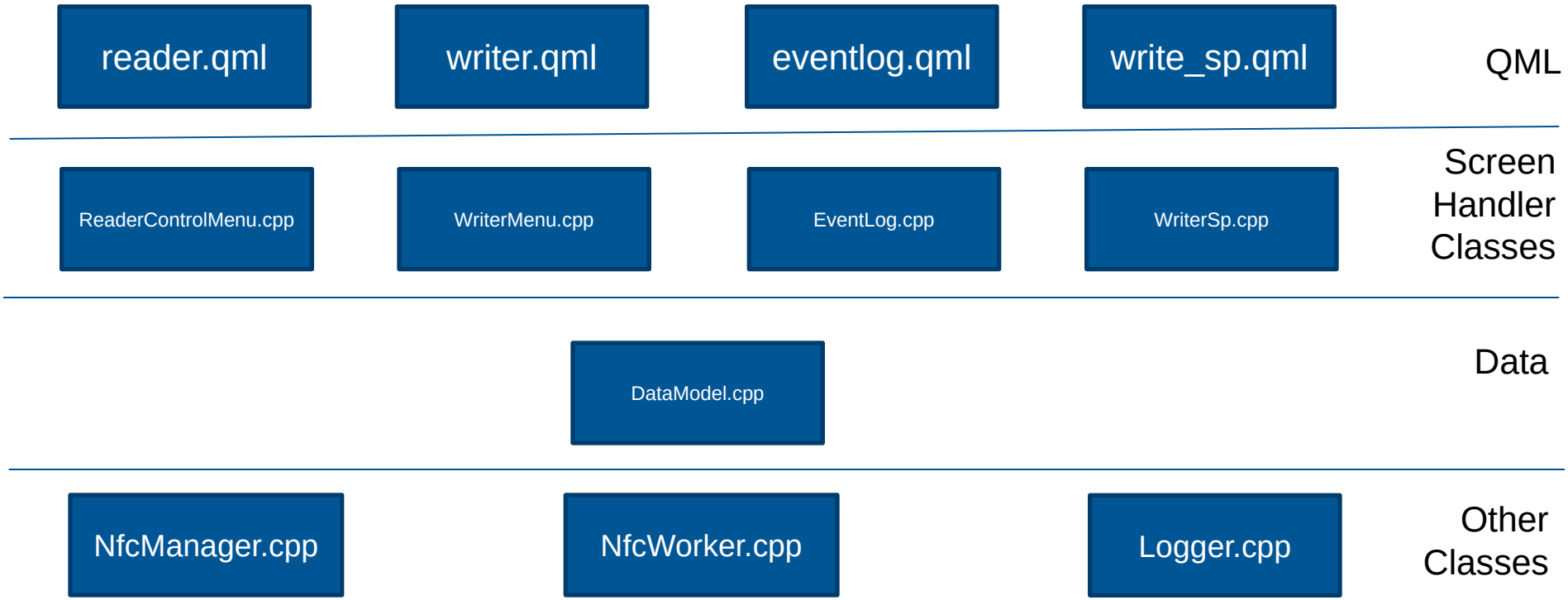
- John and Martin are developing a sample application called “Tag Tool” which will be released as open source via GitHub
- Let’s look at some other aspects of Tag Tool briefly

Tag Tool Architecture



- Let’s consider the following challenges:

1. How to create the user interface
2. How to integrate the UI with C++ components

User Interface Development

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- For the UI we used Cascades
- This is super-easy and involves writing QML, a declarative language for user interfaces, with JavaScript and attribute bindings
- QML is what gives your app its flow

```
animations: [
                SequentialAnimation {
                    id: "animation"
                    animations: [
                        FadeTransition {
                            duration: 1000
                            fromOpacity: 0.0
                            toOpacity: 1.0
                        }
.......
```

UI / C++ Integration

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- C++ objects can be stored in the context of a QML document and its properties exposed for use from JavaScript in the QML page
- Exposing properties involves use of the Qt Q_PROPERTY macro
- Let’s look at an example involving the version number of our sample application

UI / C++ Integration

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```
// MainMenu.hpp

class MainMenu : public QObject
{
  Q_OBJECT
  Q_PROPERTY(QString appVersion READ appVersion WRITE setAppVersion NOTIFY detectAppVersionChanged)

public:
    MainMenu();
    virtual ~MainMenu();

    QString appVersion() const;
    void setAppVersion(QString appVersion);

private:
    QString _appVersion;
    QmlDocument *_qml;

signals:
    void detectAppVersionChanged();

};
```

UI / C++ Integration

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```
// MainMenu.cpp

MainMenu::MainMenu() : _appVersion(QString(Settings::AppVersion)) {
      _qml = QmlDocument::create("main.qml");
      _qml->setContextProperty("_mainMenu", this);
}

// maps to READ function in Q_PROPERTY
QString MainMenu::appVersion() const {
      return _appVersion;
}

// maps to WRITE function in Q_PROPERTY
void MainMenu::setAppVersion(QString appVersion) {
      _appVersion = appVersion;

// “tell” QML that the value has changed by emitting a signal
      emit detectAppVersionChanged();
}
```

UI / C++ Integration

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```
// main.qml

Label {
            layoutProperties: DockLayoutProperties {
                verticalAlignment: VerticalAlignment.Top
                horizontalAlignment: HorizontalAlignment.Center
            }

// note use of object name as registered in call to setContextProperty in MainMenu.cpp
//    _qml->setContextProperty("_mainMenu", this);

            text: "NFC Tag Tool V" + _mainMenu.appVersion
            textStyle.base: SystemDefaults.TextStyles.BigText
      }
```

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Writing NFC Tags

John Murray

Developing your own tag writer

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- Initialise the BlackBerry Platform Services (BPS) library
- Request NFC events from the BPS
- Register for NFC NDEF target detection events
- Process NFC event objects in an event loop

Register for Tag Detection

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Here we register for NFC tag detection.

In particular we refine this request to register for **NDEF_TAG** target detection events only.

It's also possible to request notification of target types **ISO_14443_3** and **ISO_14443_4**

```
nfc_register_tag_readerwriter(NDEF_TAG);
```

Handling an NFC Event to Write(1)

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```
void NfcManager::handleNfcEvent(bps_event_t *event) {

    // Get Target to write to from the BPS event
    nfc_target_t *target;
    nfc_get_target(event, &target);

    // Construct a URI("U") type NDEF Record
    // from a uri of length uri_len (containing prefix)
    nfc_ndef_record_t* record;
    nfc_create_ndef_record(NDEF_TNF_WELL_KNOWN,
                           "U", uri, uri_len, 0, &record );
...
```

Handling an NFC Event to Write(2)

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```
...
    // Create an empty NDEF Message
    nfc_ndef_message_t* message;
    nfc_create_ndef_message(&message));

    // Add the NDEF record to the NDEF message
    nfc_add_ndef_record(message, record));

    // Write the NDEF Message to the target
    nfc_write_ndef_message_to_tag(target, message, false);
...
```

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Sample Code Review #2

John Murray

- Let's consider the following challenges:
  - **How to navigate within the UI and pass control around**
  - How to ensure your UI does not block when executing NFC operations

Navigation and Control

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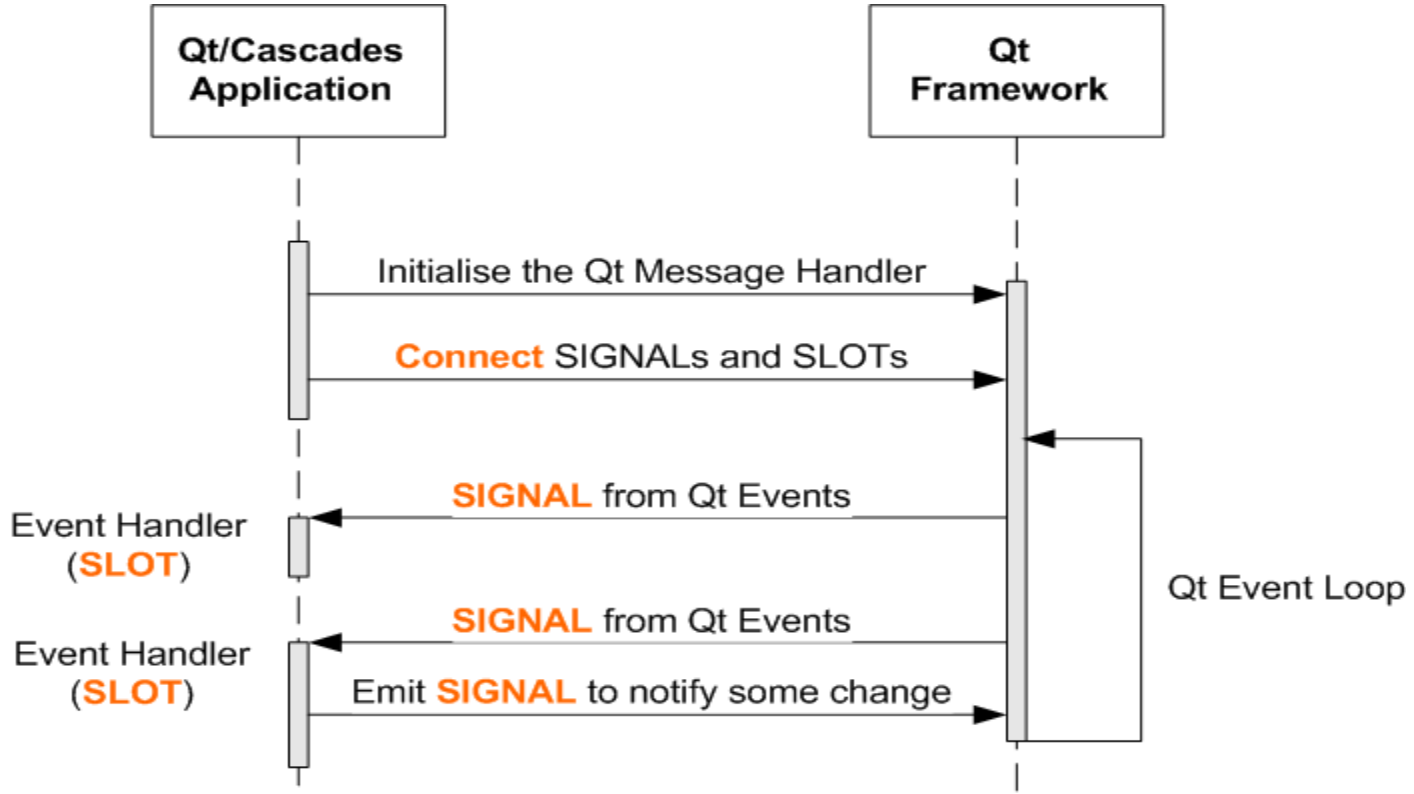
- Qt includes a powerful capability known as “signals and slots”.
- Objects can emit signals
- Slots are functions which are called when a connected signal is emitted elsewhere
- Signals and slots can be linked by connecting them in a potentially many:many configuration
- If you prefer to think of things visually …

Navigation and Control



Navigation and Control

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- Example: clicking the Write Tag button must trigger the tag writing process
- Our QML contains the Write Tag button

```
Button {
        id: btn_start_write_operation
        objectName: "btn_start_write_operation"
        text: "Write Tag"
        imageSource: "images/write.png“
}
```

Navigation and Control

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- Our C++ header file defines a slot called “startWriteProcess”

```
public slots:
    void show();
    void onMainMenuTriggered();
    void onBackTriggered();
    void startWriteProcess();
    void onUriChanged(QString uri);
```

- The QML Button object has a signal called “clicked” defined as standard

Navigation and Control

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- Our C++ object connects:
  - the “clicked()” **signal** of the Button
  - to the “startWriteProcess()” **slot** which it implements

```
Button* btnStartWrite =
    _root->findChild<Button*>(
            “btn_start_write_operation”
);

QObject::connect(
          btnStartWrite, SIGNAL(clicked()),
          this, SLOT(startWriteProcess())
);
```

Navigation and Control

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- “startWriteProcess()” kicks off the NFC operation and then calls a function to cause the next screen to be displayed

```
void WriteURI::startWriteProcess() {
   NfcManager* nfc = NfcManager::getInstance();
   nfc->writeUri(&_uri);
   _eventLog->show();
}
```

Navigation and Control

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- Showing the next screen

```
// elsewhere we create the QmlDocument
qml = QmlDocument::create("eventlog.qml");

// our show() function actually displays it

void EventLog::show() {
   _root = qml->createRootNode<AbstractPane>();
   Application::setScene(_root);
   ....
}
```

- Let's consider the following challenge:
  - **How to ensure your UI does not block when executing NFC operations**

Worker Threads

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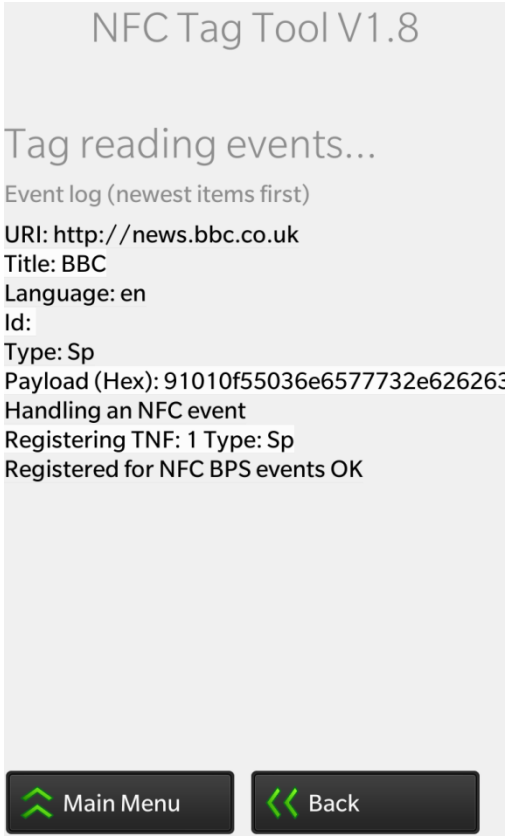
- Reading events from the BPS event queue will block.
- If you perform BPS operations in the main UI thread then this will impact the user experience.
- So, we need to run NFC operations in a different thread to the main UI thread



Useful Qt Threading Techniques

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- The Qt Framework has a rich set of classes that can be used to run NFC operations in a separate thread such as:
  - Qthread, QtConcurrent
- Many of the Qt examples on the web focus on sub-classing QThread which can result in more convoluted code.
- There is, in fact, a very simple pattern for using QThread without sub-classing. There is a very good tutorial covering this pattern (see link below) which we use in our own code sample.
  - http://mayaposch.wordpress.com/2011/11/01/how-to-really-truly-use-qthreads-the-full-explanation/

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Closing Remarks

Martin Woolley

For More Information…

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- Articles and open source code:
  - http://supportforums.blackberry.com/t5/Java-Development/NFC-Article-and-Code-Index/ta-p/1538775
- Twitter
  - Martin - @mdwrim
  - John - @jcmrim
  - @blackberrydev
- Come and talk to us here at the event!
  - Ask the Experts
- BlackBerry Developer Blog - http://devblog.blackberry.com

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THANK YOU

John Murray and Martin Woolley

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