Symbian OS Architecture

Lance Li
Technical Consultant
Audience

- Operating System Knowledge
- Design patterns Concept
- Some Programming Experience

- Need S60 / UIQ Programming Experiences? No
Agenda

- Overview
- Layers
- Kernel
- Design Patterns
- Summary
Agenda

- Overview
- Layers
- Kernel
- Design Patterns
- Summary
Overview

• History
  
  … 1998 - Symbian was formed by Psion, Nokia, Ericsson and Motorola.

  … First Symbian phone was released in 2000
    • Ericsson R380

  … 2.5G phone released early 2002
    • Nokia 7650

  … 3G phone released in December 2002
    • 3G FOMA F2051 from Fujitsu

  … EKA2 was announced in 2004

  … Security Platform was introduced in 2005 on v9
Overview (continued)

• Development Languages
  ... C++
  ... Java
  ... Flash Lite
  ... Python, Ruby
  ... OPL
  ... PIPS
Overview (continued)

- Symbian C++
  ... Leaves
  ... Cleanup
  ... Descriptors
  ... Active Object
Overview (continued)

• Versions
  ... v6.0, v6.1, v7.0, v7.0s, v8.0, v8.1a, v8.1b, v9.1...v9.5

• True Micro-Kernel
  ... User Mode & Kernel Mode
  ... Only a minimal parts of system runs as kernel mode
  ... Real-Time OS
Overview (continued)

- Features
  - GUI
  - Telephony
  - Multimedia
  - Messaging
  - Networking
  - Short link (USB, Bluetooth, IR)
  - Security
Agenda

• Overview
• Layers
• Kernel
• Design Patterns
• Summary
Layers

- 5 Layers
- Design Patterns
- C++ Component Based
- DLL
Layers (Continued)

Symbian OS

Engine
- Agenda
- Contacts
- Office
- Messaging
- Browsing

Middle-ware
- Java
- MIDP
- XVM/Personal Java
- Java Phone

Application Framework
- GUI framework
- Text
- Graphics

Personal Area Networking
- BlueTooth
- IR
- USB

Multimedia
- Image
- Sound
- Video

Base
- File Server
- Kernel Process

Messaging
- POP3
- IMAP4
- Fax
- MMS
- SMS

Comms
- TCP
- IP
- HTTP
- WAP

Telephony
- GSM
- GPRS
- CDMA

Security
- cryptography
- Certificate management
- s/w install
Layers (Continued)

- **UI Framework**
- **Application Services**
  - **Java J2ME**
  - **OS Services**
    - **Generic Services & Generic Libraries**
    - **Comms Services**
    - **Multimedia & Graphics Services**
    - **Connectivity Services**
- **Base Services**
- **Kernel Services & Hardware Abstraction**
Layers (Continued)

- What are in every layers?
Layers – UI Framework

UI Framework

Application Services

OS Services

Base Services

Kernel & Hardware

Java
Layers – UI Framework (continued)
Layers – Application Services

UI Framework
Application Services
OS Services
Base Services
Kernel & Hardware

Application Services
Java
Layers – Application Services

- Application Oriented Interfaces
- Internet & Web App Support

Application Services:
- PIM
- Office
- Device Management
- Data Synchronization
- Client Provisioning
- Messaging Subsystem
- Content Handling
- Application Framework
- Internet & Web Application
- Multimedia Protocols

Layer Components:
- PIM Application Services
- Bookmark Support
- WAP Push framework
- WAP Push MTM
- HTTP Trans. Framework
- HTTP Provider
- RTP
- SIP Framework
- SIP Connect Provider Plugins
- TCP Engine
- Telnet Engine
Layers – OS Services (continued)

- Core System Services and Frameworks
Layers – OS Services (continued)

UI Framework

Application Services

Java

OS Services

Generic OS Services

Base Services

Kernel & Hardware
Layers – OS Services (continued)
Layers – OS Services (continued)
## Layers – OS Services (continued)

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Java
Layers – OS Services (continued)

Multimedia & Graphics Services

Multimedia
- Multimedia Firmware
- Image Conv. Library
- Camera
- Broadcast Tuner

Windowing Framework
- Window Server
- OpenGL ES
- OpenGL ES Firmware

Graphics and Printing Services
- Bit GDI
- Text Shaper Plugin
- Font & Bitmap Server
- Font Store
- FreeType Font Raster
- Reference Fonts
- Printer Driver Support
- Printer Drivers

Graphics Device Interface
- GDI
- Colour Palette

Multimedia & Graphics Services
Layers – OS Services (continued)

UI Framework

Application Services

OS Services

Generic OS Services

Comms Services

Multimedia and Graphic Services

Java

Connectivity Services

Base Services

Kernel & Hardware
Layers – OS Services (continued)

Service Providers
- PLP Variant
- Remote File Server
- Software Install Server
- Secure Backup Engine
- Secure Backup Socket Server

Service Framework
- Service Broker

Device Connection
- m-Router
- Bearer Abstraction Layer
- Server Socket

Connectivity Services
Layers – Base Services

UI Framework
Application Services
OS Services
Base Services
Kernel & Hardware

Java

Base Services
Layers – Base Services (continued)

- Extend the Kernel
- User Side of Operating System
Layers – Base Services (continued)

- Base Services

![Diagram showing the layers of Base Services]

- Low Level Libraries and Frameworks
  - Crypto Library
  - User Library
  - File Server
  - FAT file name Conv. Plugins
  - File Systems

- Character Conversion
  - Char. Encode.
  - Conv.
  - Frmwrk.
  - Plugins

- Media Device Framework
  - Media Device Frmwrk.
  - Plugins

- Text Mode Shell
  - Text Window Server
  - Text Shell

- User Library and File Server

- User Side
  - Hardware Abstraction
  - User HAL
Layers – Kernel & Hardware Interface

- UI Framework
- Application Services
- OS Services
- Base Services
- Kernel & Hardware

Java

Kernel & Hardware Interface
Layers – Kernel & Hardware Interface (Continued)
Layers (Continued)

- UI Framework
  - Pure C++ Component Based
  - Frameworks
  - Plug-Ins
  - Server (process) / Client (process)
  - Extensibility

- Application Services

- OS Services

- Base Services

- Kernel & Hardware
Agenda

• Overview
• Layers
• Kernel
• Design Patterns
• Summary
Kernel

UI Framework

Application Services

OS Services

Base Services

Kernel & Hardware

Java

Kernel Architecture
Kernel (Continued)

Features

- Privilege
- Multi-Tasking
- Hardware Independent
- RTOS
- Pre-Emptive
- XIP
Kernel (Continued)

Services

- Process
- Memory
- Interrupt
- Thread
- Device
- Power
Kernel (Continued)

- Architecture

User Library

NanoKernel  MM  Kernel  Extensions

Viriant  ASSP

LDDs  PDDs
Kernel (Continued)

• Memory Model

Moving Memory Model

Multiple Memory Model

Single Memory Model

Emulator Memory Model
Memory Model --- 32 Bits Flat Addressing

0x87654321

0x876

0x54

0x321

0x321
Kernel (Continued)

- Moving Memory Model --- Processes
Kernel (Continued)

- Moving Memory Model --- Cache

![Diagram showing cache and memory structures]
Kernel (Continued)

- Multiple Memory Model --- Processes
Kernel (Continued)

- Multiple Memory Model --- Cache

```
0x87654321
```

```
Process Identifier
```

```
Cache
```

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Agenda

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Design Patterns

- Abstract Factory

Client

BaseFactory
VTable
CreateProduct()

DLL

ImplFactory
CreateProduct()

Product

Pointer

BaseFactory
VTable
CreateProduct()

*.h

BaseFactory
CreateProduct()
Design Patterns (Continued)

- Abstract Factory of Application Creation
Design Patterns (Continued)

- Abstract Factory of Messaging Subsystem

- POP3 Email Client DLL
- POP3 Email Connection DLL
- Messaging Client API
- Messaging Server EXE
- Application

Hi, Use POP3 !!!
Design Patterns (Continued)

- Observer

```
AbstractSource
  InsertObserver()
  DeleteObserver()
  NotifyObservers()

ConcreteSource
  SomeChange()

ConcreteObserver
  virtual void Update()
  {
    for each observer
    {
      observer.Update();
    }
  }
  void SomeChange()
  {
    NotifyObservers();
  }
```

VTable
Design Patterns (Continued)

- Observer of Application
Design Patterns (Continued)

- Observer of Messaging Subsystem

```
+----------------+                  +----------------+                  +----------------+
| SMS Application |                  | MSV Session Observer |
|                +----------------+                  +----------------+                  +----------------+ |
|                |                |  API                |                |                |                |
|                +----------------+                  +----------------+                  +----------------+ |
|                |                | Messaging Client    |                |                |                | Message Server |
|                +----------------+                  +----------------+                  +----------------+ |
|                |                +----------------+                  +----------------+                  +----------------+
|                |                | EXE                  |                |                |                |
```

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Design Patterns (Continued)

- Frameworks, What & Why
Design Patterns (Continued)

- Frameworks

![Diagram of a framework with high level system, extended API, extended feature, plug-ins, and lower level system.]
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Summary

Overview

Layers

UI Framework
Application Services
OS Services
Base Services
Kernel & Hardware

Java

Kernel

Design Patterns

Abstract Factory
Observer
Frameworks
Symbian Press
Web Resources

- http://www.symbian.com
- http://developer.symbian.com
Thanks!