Formal Modelling of Feature Configuration Workflows
## Product Category
- Inspiron Laptops
- Mini Netbooks
- Studio Laptops
- Adamo
- XPS Laptops
- Studio XPS Laptops
- Gaming Laptops

## Need it Fast?
- Ships Out Next Business Day

## Operating System
- Windows 7
- Windows Vista
- Windows XP Home
- Ubuntu Linux

## How much storage do you need?
- **1TB:** 18,500 hrs of music or 1,500 hrs of video
- **500GB:** 9,250 hrs of music or 750 hrs of video
- **320GB:** 5,900 hrs of music or 500 hrs of video
- **160GB:** 3,000 hrs of music or 250 hrs of video
- I want a solid state drive

## Optical Drive
- CD/DVD+RW
- Blu-Ray Disc

## Laptop Weight
- < 5 lbs. (Ultra Light)
- 5 - 7 lbs. (Light)
- > 7 lbs. (Desktop Replacement)

## Memory
- More than 4GB
- 4GB
- 3GB
- 2GB
- 1GB

## Laptop Screen Size
- 17"
- 15.6"
- 14"
- 13.3"
- 10.1"

## Video Card Type
- Integrated Graphics
- Dedicated Video Card

## How fast does it need to be?
- Gaming - superior speed for hi-def mobile gaming
- Power - ultimate speed for complex applications
- Multimedia - ideal for video playback and multitasking
- Normal - everyday use
- Efficient - optimise battery life

## Price
- Less than $500
- $500 to $800
- $800 to $1200
- Over $1200

## Compare All Laptops
- View All Laptops
# Narrow Your Laptop Selection

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## Compare All Laptops
- View All Laptops
Mini 10v (Ubuntu)
- Intel® Atom Processor® N270 (1.6GHz/533Mhz FSB/512K cache)
- UBUNTU 8.04 (Standard Edition)
- 16GB Solid State Drive
- 1GB3 DDR2 SDRAM6

Starting Price $309
As low as $15/month

Customize
Product Category
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Dell Laptop

Feature Diagram

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- Need it Fast?
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- Operating system

excludes
Collaborative feature-based configuration
Collaborative feature-based configuration
Collaborative feature-based configuration
Collaborative feature-based configuration
Collaborative feature-based configuration
1 Introduction

2 Motivating Example

3 Feature Configuration Workflows

4 Wrap up
Motivating Scenario
Motivating Scenario

Spacebel
Motivating Scenario

Spacebel

Reseller
Motivating Scenario

S  Spacebel

R  Reseller

E  System Engineer
Motivating Scenario

Spacebel
Reseller
System Engineer
Network Integrator
Motivating Scenario

Spacebel

Reseller

System Engineer

Network Integrator

TMTC Integrator
Motivating Scenario

CFDP library

- PUS
  - PUS Copy
  - PUS Rename
  - Send
    - Send Filestore Operations
    - Send Acknowledged mode
  - Receive
    - Receive Filestore Operations
    - Receive Acknowledged mode
  - Extended
  - Reboot
    - Reboot Entity
    - Reboot PUS

Spacebel

Reseller

System Engineer

Network Integrator

TMTC Integrator
YAWL

Legend

Conditions

Start

End

Task

AND

XOR

Split

AND

XOR

Join
Legend

- Conditions
- Start
- End
- Task
- AND
- XOR
- Split
- Join
YAWL

Optional configuration

Legend
- **Conditions**
- **Start**
- **End**
- **Task**
- **AND**
- **XOR**
- **Split**
- **Join**

Spacebel -> Reseller

System Engineer -> Network Integrator

(TMTC Integrator) -> (loop) -> Product release
YAWL

Optional configuration

Parallel configuration

Legend

- Conditions
- Start
- End
- Task
- Split
- AND
- XOR
- Join
Optional configuration

Parallel configuration

Legend

Conditions

Start

End

Task

AND

XOR

Split

Join
1 Introduction
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4 Wrap up
Intuition
Intuition
Intuition
Intuition

What

CFDP library
  - PUS
    - PUS Copy
    - PUS Rename
  - Send
    - Send Filestore Operations
    - Send Acknowledged mode
  - Receive
    - Receive Filestore Operations
    - Receive Acknowledged mode
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Who

When

Spacebel  →  Reseller  →  Network Integrator  →  TMTC Integrator  →  Product release

System Engineer  (loop)
Intuition

What

- CFDP library
  - PUS
    - PUS Copy
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Who

- S
- E
- N
- R
- T

When

- Spacebel
- System Engineer
- TMTC Integrator
- Network Integrator
- Reseller
- Product release
Combined Formalism
Configuration workflow

- Reseller
  - CFDP library
  - [PUS]
  - [PUS Copy]
  - [PUS Rename]
  - Send
  - [Send Filestore Operations]
  - [Send Acknowledged mode]
  - Receive
  - [Receive Filestore Operations]
  - [Receive Acknowledged mode]
  - Extended
  - Reboot
    - [Reboot Entity]
    - [Reboot PUS]

- System Engineer
  - Task

- Network Integrator
  - Task

- Final Satellite
  - Stop

- Product release
  - Stop

- Spacebel

- TMTC Integrator
  - Task

- Spacebel FD
  - CFDP library
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Configuration workflow

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- Spacebel
- System Engineer
- Network Integrator
- Final Satellite
- Product release

- TMTC Integrator

Task

Stop
Configuration workflow

- Reseller
  - Spacebel CFDP library
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- Network Integrator
  - System Engineer
    - (loop)
- Final Satellite
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Network Integrator FD
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Spacebel FD
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System Engineer FD
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TMTC Integrator FD
CFDP library
- PUS
  - PUS Copy
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Spacebel.PUS Copy  <<equals>> TMTC.PUS Copy
Spacebel FD

CFDP library

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Network Integrator FD

CFDP library

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System Engineer FD

CFDP library

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TMTC Integrator FD

CFDP library

- PUS
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Spacebel.PUS Copy "equals" TMTC.PUS Copy
Spacebel FD
CFDP library
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Network Integrator FD
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TMTC Integrator FD
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Spacebel.PUS Copy <<equals>> TMTC.PUS Copy
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Spacebel FD

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TMTC Integrator FD

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Configuration workflow

1. Spacebel
2. Reseller
3. System Engineer
4. Network Integrator
5. Final Satellite
   (loop)

Task stop

Spacebel FD
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Product release

Task stop
Configuration workflow

1. Spacebel
2. System Engineer
3. Network Integrator
4. (loop)
5. Final Satellite
6. Product release

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System Engineer FD
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  - Reboot Entity
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TMTC Integrator FD
- CFDP library
  - PUS
  - PUS Copy
  - PUS Rename

Stop

Task
Frontend

Backend
Frontend + Backend
Frontend

backend

satisfiable?
deread features?
...

+ 

termination?
reachable task?
...

+ 

...
Frontend

Backend

satisfiable?
dead features?
...

+ 

termination?
reachable task?
...

...
1 Introduction
2 Motivating Example
3 Feature Configuration Workflows
4 Wrap up
Feature Configuration Workflows

1. Introduction
2. Motivating Example
3. Feature Configuration Workflows
4. Wrap up
Explicit Modularisation Process Specification

Automation
Benefits

1 Non-trivial process modelling

Future work
Benefits

1. **Non-trivial process modelling**

2. **Assistance to product managers**

Future work
Benefits

1. **Non-trivial process modelling**

2. **Assistance to product managers**

3. **Improved separation of concerns**

Future work
Benefits

1. Non-trivial process modelling
2. Assistance to product managers
3. Improved separation of concerns
4. Formal verification

Future work
Benefits

1. Non-trivial process modelling
2. Assistance to product managers
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4. Formal verification

Future work

1. Asynchronous configuration
Benefits

1. Non-trivial process modelling
2. Assistance to product managers
3. Improved separation of concerns
4. Formal verification

Future work

1. Asynchronous configuration
2. Efficient reasoning algorithm
Benefits

1. Non-trivial process modelling
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3. Improved separation of concerns
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Future work

1. Asynchronous configuration
2. Efficient reasoning algorithm
3. Prototype development
**Benefits**

1. **Non-trivial process modelling**
2. **Assistance to product managers**
3. **Improved separation of concerns**
4. **Formal verification**

**Future work**

1. **Asynchronous configuration**
2. **Efficient reasoning algorithm**
3. **Prototype development**
4. **Validation**