DSNAnalyzer: Backend for the Deployment Support Network

Master Thesis
Computer Science
ETH Zurich

Oehen, Patrice

September 26, 2006
Outline

**DSNAnalyzer**
- Goals
- Views / Test Execution
- DSN Evaluation

**Link Quality Measurements**
- Introduction
- Base Measurements
- Fading
- Interference

**Summary / Outlook**
Goals

- Integration of the DSN with the Siemens A80 Target

- Design and implementation of a **WSN-Prototyping tool** for
  - Analyzing
  - Controlling
  - Testing

- Planning and Execution of Link Quality Measurements
Control View

3D Map

Log
Test Execution Process

Diagram:
- **DSN Layer**
  - DSN Server
  - GUI Node
  - DSN Node
  - DSN Server

- **Link Quality Chart**
  - RSSI Correct Frames
  - RSSI Faulty Frames
  - RSSI Noise

Flow:
1. **Set Test Parameters**
2. **Start Sending**
3. **Stop Sending**
4. **Start Receiving**
5. **Compute Results**
6. **Target**

Legend:
- **DSN Server**
- **GUI Node**
- **DSN Node**
- **Target**
Analyze Test View

Packet Reception Chart

Link Quality Chart

RSSI Chart

Bit Errors / RSSI

1 Sender – N Receivers

1 Sender – 1 Receiver
Analyze View

3D Map

Sequence Chart

Log


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DSN Evaluation

- 😞 “Blue Box” Battery Lifetime: ~ 48 h
- 😊 Binary Distribution at 30 nodes in 120 s (خطأ: Flashing has still problems)
- 😊 Average of 1 Watchdog-Reset in 48 h, hardly no hang-ups
- 😞 Command Execution
  - 1 s for 1 hop
  - 1.5 s for 6 hops
- 😞 Logging
  - Rate < 1/s for 100%
  - Rate < 3/s for 90% and 5 Targets
- DSN-Node Range (Office Building)
  - 25 m if DSN-Nodes on the ground
  - > 55 m if DSN-Nodes 70 cm height
- DSNAnalyzer used for
  - Improving simulated protocols
  - Performing extensive measurements
Link Quality Measurements

- Link Behavior
- Link Quality / Signal Strength
- Fading Properties
- Interference

Development Process

- Simulation
- Implementation
- Improve Implementation
- Improve Models

Two Main Goals

- Provide Information for Simulation and Implementation
- Prove the functionality of the DSNAnalyzer
EMC Base Measurements

- “Burn In” Test over 50 h with 1’500’000 frames
  Result: All frames correctly received
- 😊 Same Result with “Blue Box”

Link Quality over one floor in GS2a

RSSI Chart

(Sender)

- RSSI Range of correct received frames
- RSSI Range of faulty received frames
- RSSI Range of noise
Fading - 1

Link Quality Chart

-70
-75
-80
-85
-90
-95
-100
750 800 850 900 950 1,000 1,050
Frame

RSSI [dBm]

- RSSI Faulty Frames
- RSSI Correct Frames
- RSSI Noise
- RSSI Noise

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Different Fading between day and night

Special places with large fading (basement)

Fading does only influence link quality if it goes under a certain level

Hardly no bit errors or missed frames if signal > noise + 10 dBm
Interference - 2

![Diagram showing interference measurements at 10 cm and 100 cm distances.]

**100 cm**
- **Sender**: Channel: 20
- **Receiver**: Jammer (Pos 1) and Jammer (Pos 2)

**10 cm**
- **Sender**: Channel: 20
- **Receiver**: Jammer (Pos 1) and Jammer (Pos 2)

Bar charts show the number of frames received correctly, faulty, or missed.
**Summary / Outlook**

- **DSNAnalyzer** provides …
  - Control WSN-Layer and provide sophisticated test mechanisms
  - Analyze output from Targets and Simulator
  - Analyze results from tests using charts

- **Link Quality Measurements**
  - Hardware + Software work as expected
  - There is Fading over seconds and over hours
  - RSSI as indicator for link quality (RSSI > Noise + 10 dBm)
  - Interference from other channel matters

- **Further Work**
  - Real-Time mechanism?
  - Extended 3D Map (including large obstacles)
  - Timed Commands for stimulating the Target Network
  - Performing measurements in difficult buildings
Thank you!