

NOKIA

Software shift-left by utilizing Model-based design and MathWorks code generation tools

MATLAB EXPO, Helsinki

Jouni Sillanpää / Nokia Mobile Networks, SoC
Architecture and Specification

17 May 2022



Nokia; Oulu



Facts and figures

€130bn

Invested in R&D
since 2000

~130

Countries of
operation

€22.2bn

Net sales in 2021

4,000

Patent families
declared as
essential to 5G

155+

Years in business

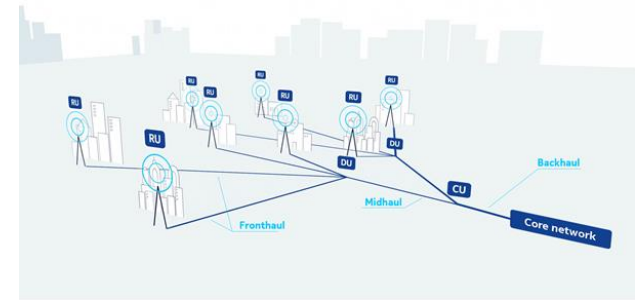
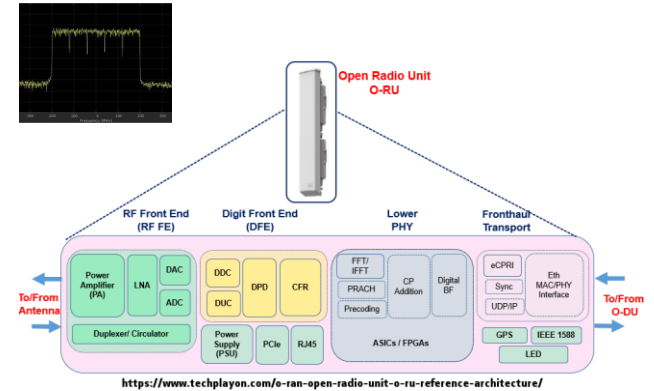
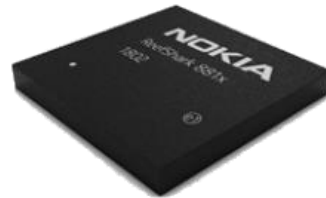
Nobel prizes

9

Application area: DFE

Digital Front End

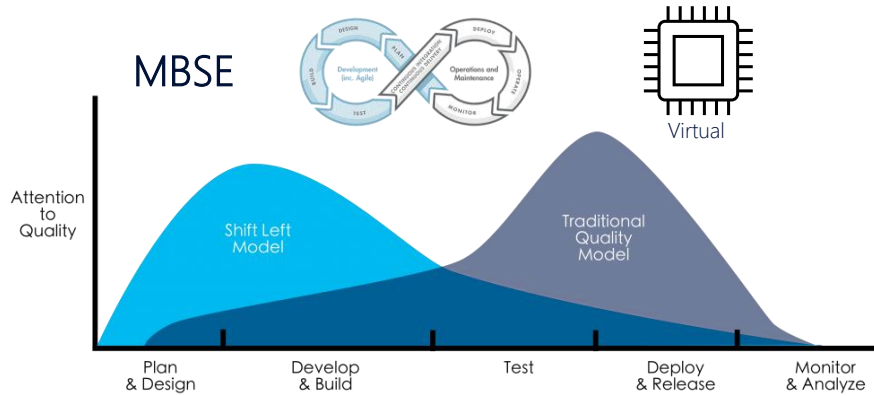
- Algorithmically complex
- Very large design
- High number of configuration parameters
- Needs to support many use cases



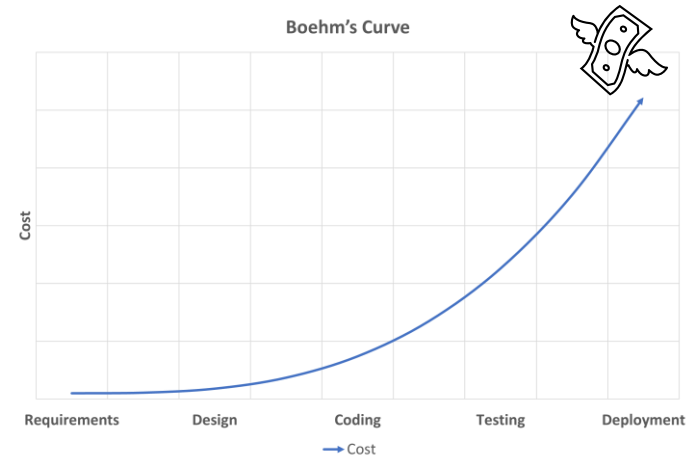
<https://www.nokia.com/about-us/newsroom/articles/open-ran-explained/> NOKIA

What is shift-left?

It is everything

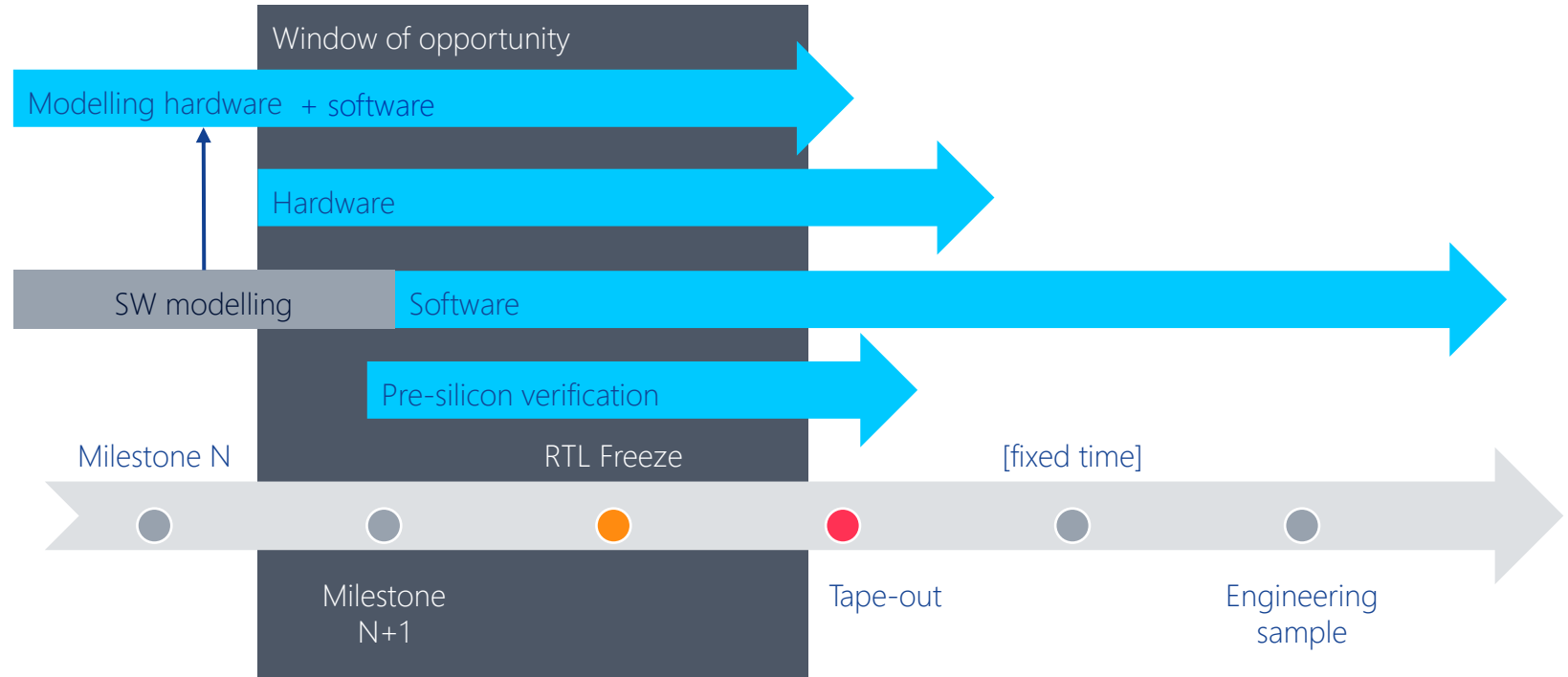


<https://devopedia.org/shift-left>



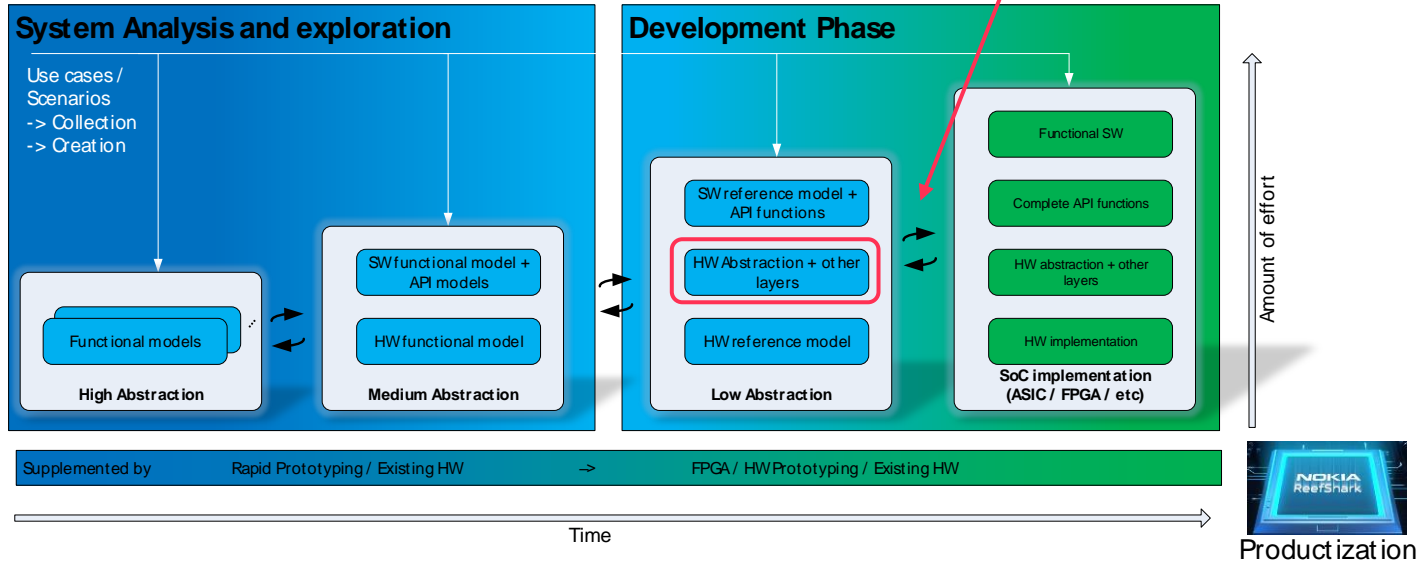
SoC design process

Agile waterfall



Modeling Phases

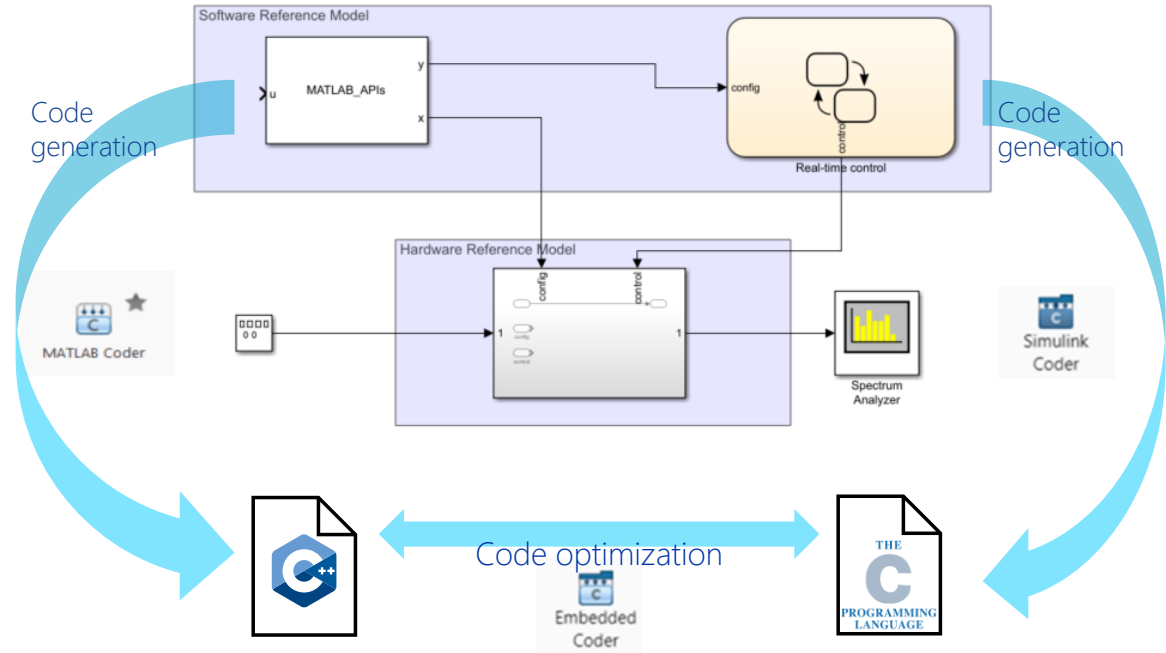
Model-based Design in Nokia 5G



Tools of the trade

MathWorks code generation tools

- MATLAB Coder
- Simulink Coder
- Embedded Coder
- Stateflow



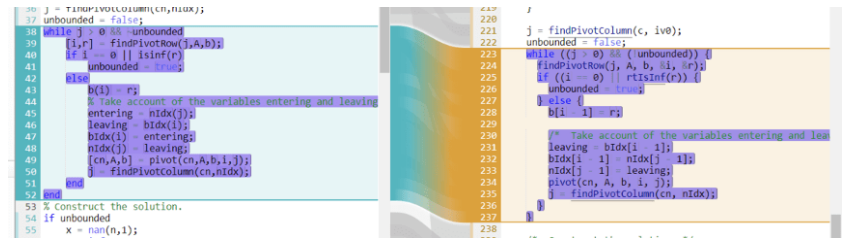
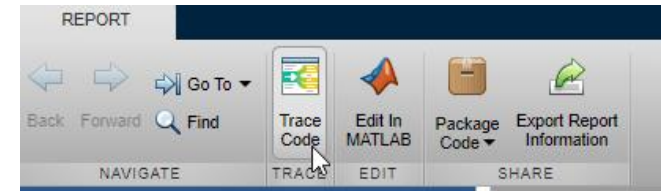
Code customization

- Interface customization
- Code generation template customization
- External code integration
- Code replacement



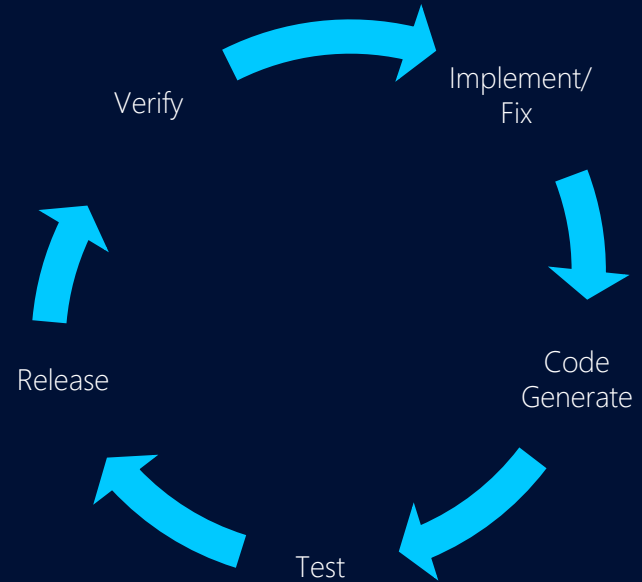
Code testing and debugging

- Code readiness analysis
- MEX file testing
- Software-in-the-Loop Execution
- Processor-in-the-Loop Execution
- Run MATLAB unit tests on the generated code
- Add run-time checking for generated code
- Generate Code Generation Report with Traceability



Key takeaways

- New workflow, new mindset
- Well timed resourcing and training
- Technical support
- Minimize external dependencies to the model
- Minimize defect fix turnaround time
- Coordinate
- Re-use and Improve



The outcome – A success story



1. Considerable software shift-left
 - In time for the “window of opportunity”
 - Approx. 6-12 months direct impact
2. Improved collaboration
3. Improved communication
4. Increased re-use
5. Increased quality
6. Executable specification

NOKIA