Top-Down Design of Wireless Transceivers

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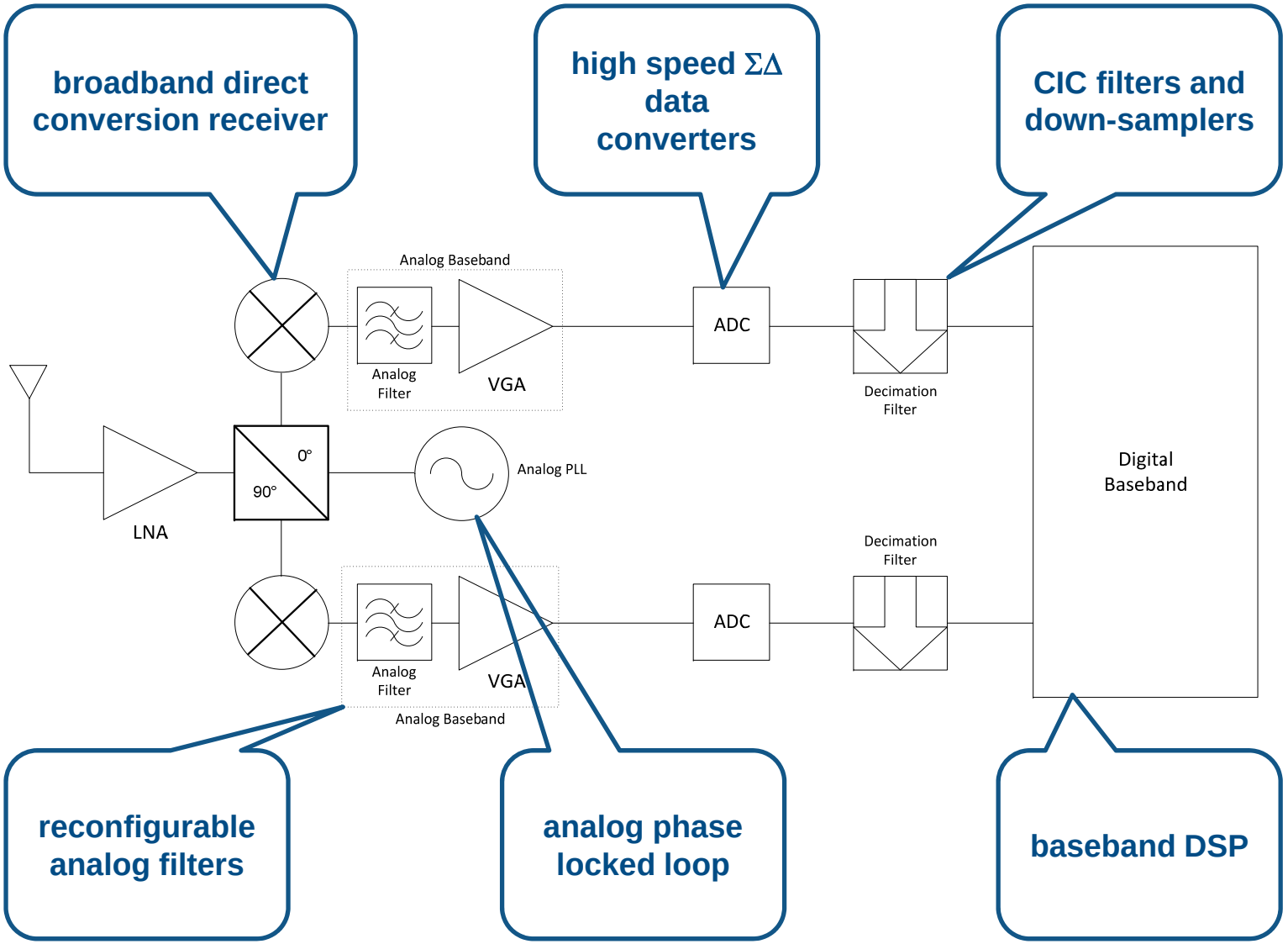
Outline of Today's Webinar

- What is top-down design?
- MathWorks tools for top-down design of wireless systems
- SimRF description
- 802.15.4 design example

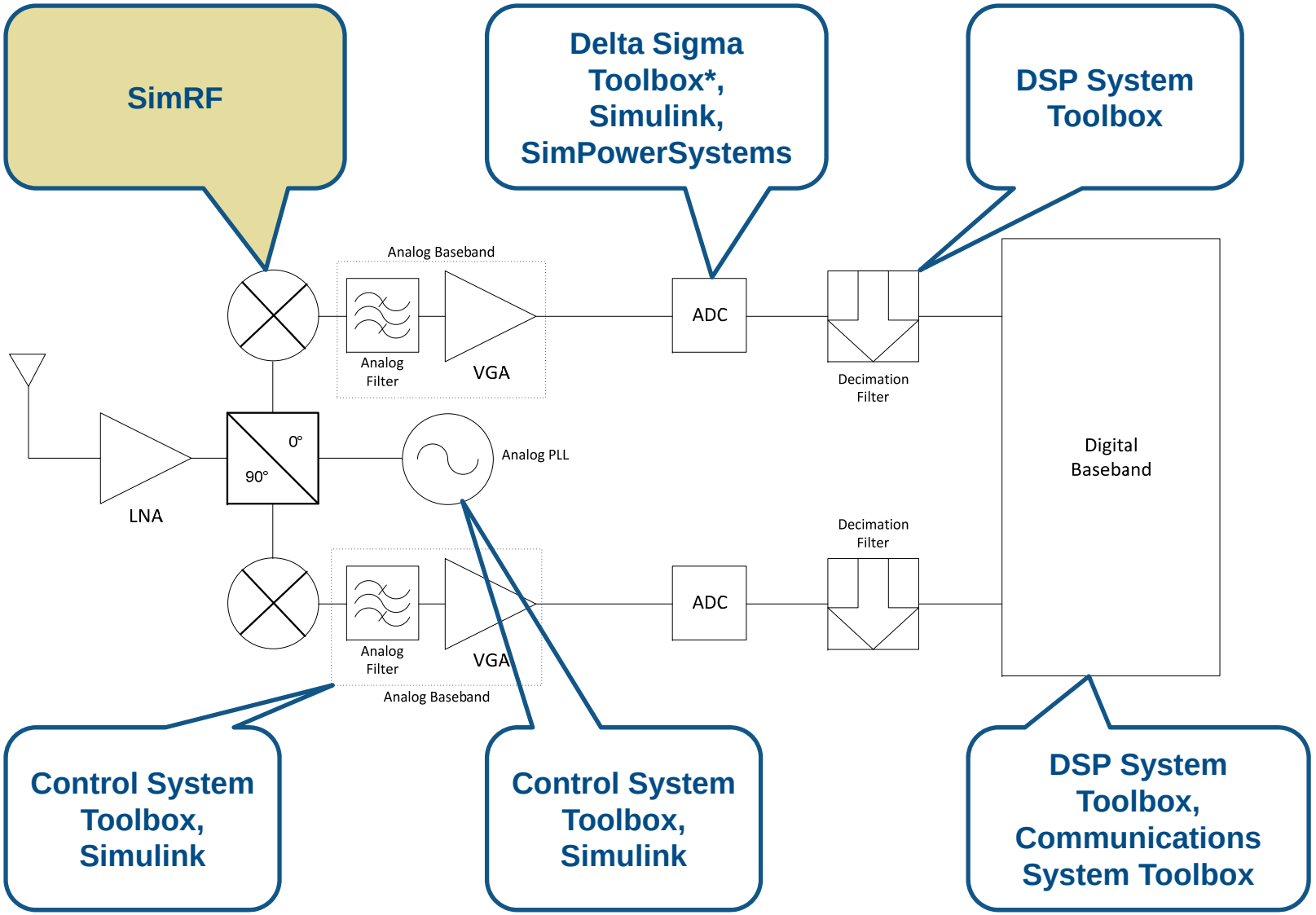
What is Top-Down Design?

"A top-down design and verification methodology systematically proceeds from architecture to transistor level design. Each level is fully verified before proceeding to the next and each level is leveraged in verification of the next." –Kundert and Chang

Typical Direct Conversion Receiver Design

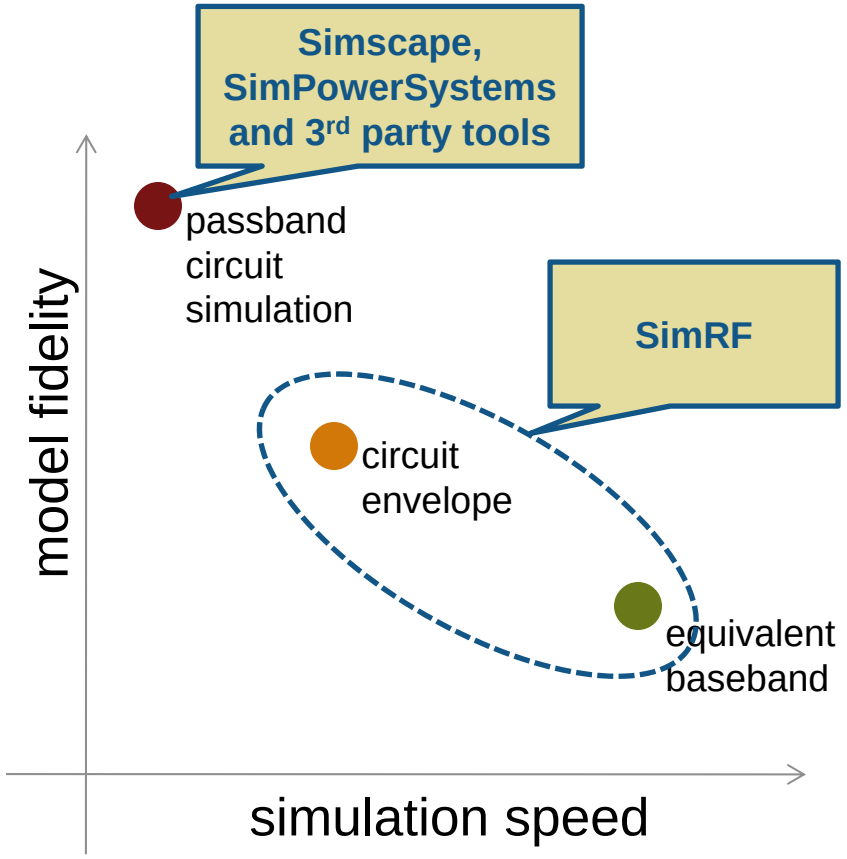


MathWorks Tools for Receiver Design

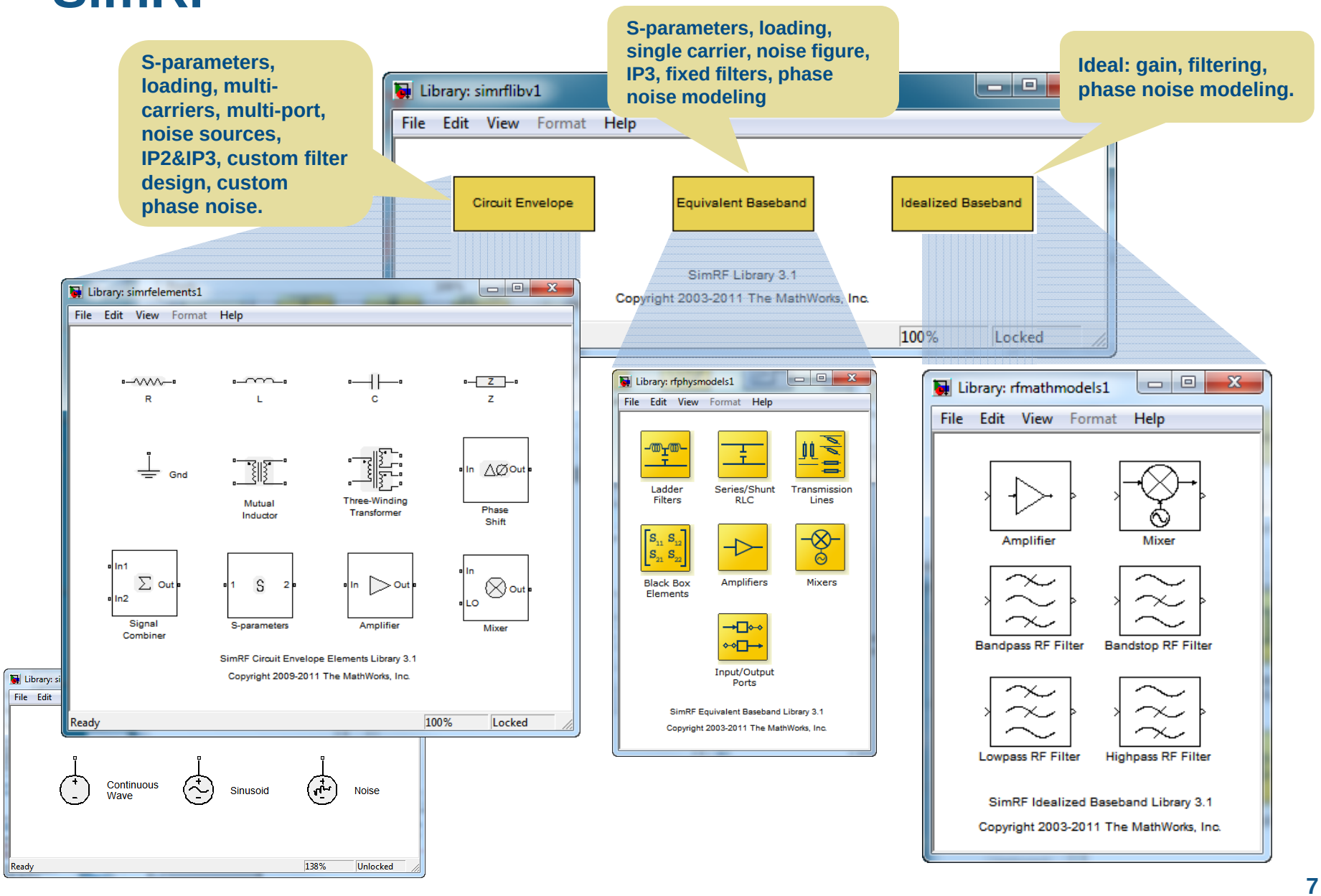


What is SimRF?

- SimRF is MathWorks tool for system level design and simulation of RF systems.
- SimRF includes:
  - Library of RF domain specific blocks
  - Equivalent baseband simulation technology for speed
  - Circuit envelope simulation technology for detailed design
- SimRF is tightly integrated with other signal processing design tools



SimRF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Design Demo

Example Design Specifications

- 802.15.4 Air Interface for 2.4 GHz ISM Band
  - 250 kbps
  - 2 Mchps
  - O-QPSK modulation
  - ½ sine pulse shaping
- Robustness to -20 dBm UMTS interference in IMT-2000 band spanning 2500 MHz to 2690 MHz
- -100 dBm sensitivity @ 0.00625% BER
- Ultra low cost

Top-Down Receiver Design Task List

1. Design and verify transmitter
2. Determine SNR requirement of receiver
3. Add behavioral ADC and determine gain and NF
4. Add direct conversion impairments and design RF receiver
5. Remove DSSS channel coding to reduce simulation time
6. Translate Eq. BB. design to Ckt. Env. and verify model performance
7. Add wideband interference, LO feed-through and offset cancellation, and re-design RF receiver
8. Design over-sampled ADC and anti-aliasing filter
9. Design and verify decimation filter

Waveform Verification Video

- The spectrum of the Zigbee® signal that will be shown in the video was captured using an Agilent ESG signal generator.
- The waveform in the video was generated using the Agilent 89600 Vector Signal Analyzer software.
- Learn more at www.agilent.com.

Go to Simulink

Wrap-up

- Today I showed you how to use MathWorks tools for top-down design of wireless systems
  - Simulink
  - DSP System Toolbox
  - Communications System Toolbox
  - **SimRF**
- For more information or for a copy of the material presented during this webinar, please contact me: chris.aden@mathworks.com

Thank you!