



Porting....It's more than just Software

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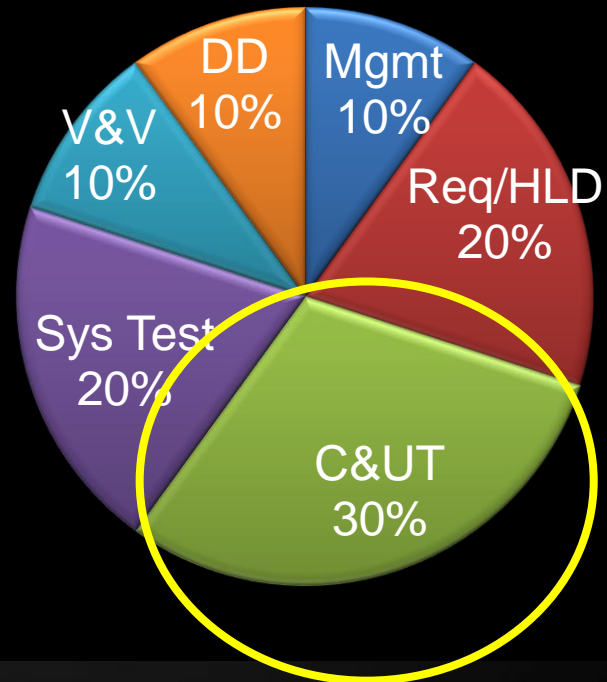
- SW Development Costs
- Harris SDR Experience
- Aspects of Re-use
- Conclusions



- Typical SW Project Cost Ratios:

- Planning/Management: 10%
- Requirements/HLD: 20%
- Detailed Design: 10%
- Code & Unit Test: 30%
- System Test: 20%
- Verification and Validation: 10%

SW Development





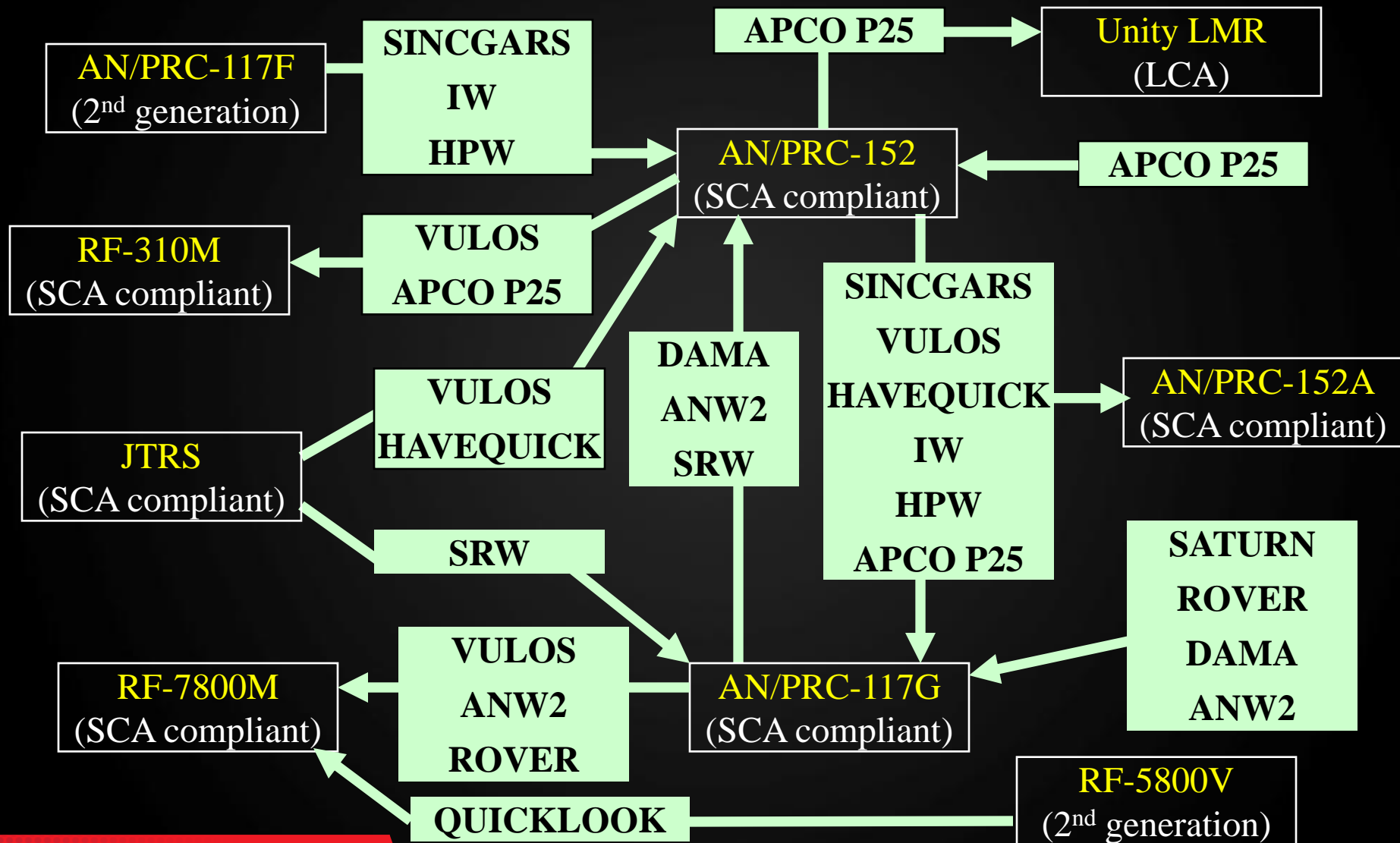
Harris SDR Experience

- 6 platforms
 - AN/PRC-117G: Type 1 Multiband Networking Man Pack
 - AN/PRC-152: Type 1 Multiband Hand Held
 - AN/PRC-152A: Type 1 Multiband Networking Hand Held
 - RF-310M: Suite B Multiband Hand Held
 - RF-7800M MP: Type 3 Multiband Networking Man Pack
 - RF-7800M HH: Type 3 Multiband networking Hand Held

- Combination of SCA 2.2.2 and 2.2
 - AN/PRC-117G, AN/PRC-152A: Common 2.2.2 Certified Operating Environment
 - RF-7800M MP , RF-7800M HH: Common 2.2.2 Operating Environment
 - AN/PRC-152, RF-310M: Common 2.2 Operating Environment; AN/PRC-152 is Certified

- Extensive SCA based Development and Deployment Experience

Waveform	PRC-117G	PRC-152	PRC-152A	RF-310M	RF-7800M MP	RF-7800M HH
VULOS	X	X	X	X	X	X
QuickLook					X	X
HQ	X	X	X		In Dev	
SINCGARS	X	X	X			
SATURN	In Dev					
TALON					In Dev	
HPW (IP)	X	X	X			
DAMA	X	X				
IW	X	X	X			
P25	X	X	X	X		
ROVER	X				X	
ANW2	X		X		X	X
SRW	X		X			



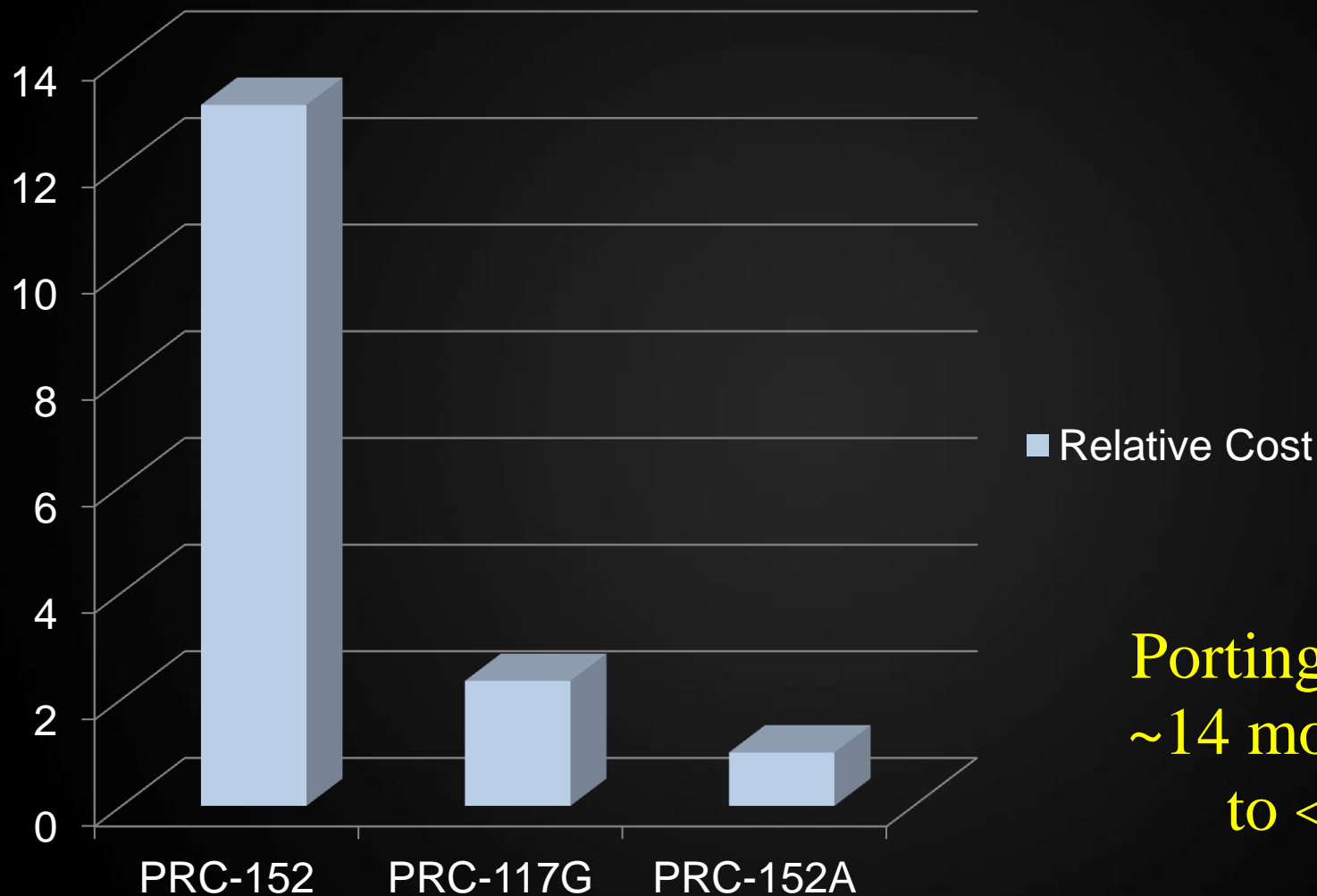
Example 1: 3rd Party Waveform



- Key Aspects:
 - “*Third party*” commercial waveform application ported to AN/PRC-152 HH
 - AN/PRC-117G MP and AN/PRC-152A done at same time but with the 117G in the lead
 - Highly collaborative approach between waveform provider and radio platform/SCA experts on original development
- Observations:
 - Commercial waveform porting required much more modification than application of software “wrappers”.
 - Functional allocation to HW and SW processing frameworks.
 - SW threading model and real-time analysis.
 - Compliance with SCA architecture and APIs presented by OE.
- Time and Cost implications:
 - Porting time from ~14 months down to < 6 months.



Example 1: 3rd Party Waveform



Porting time from
~14 months down
to < 6 months.

- Multi-phase project delivered on the AN/PRC-152, AN/PRC-152A and AN/PRC-117G

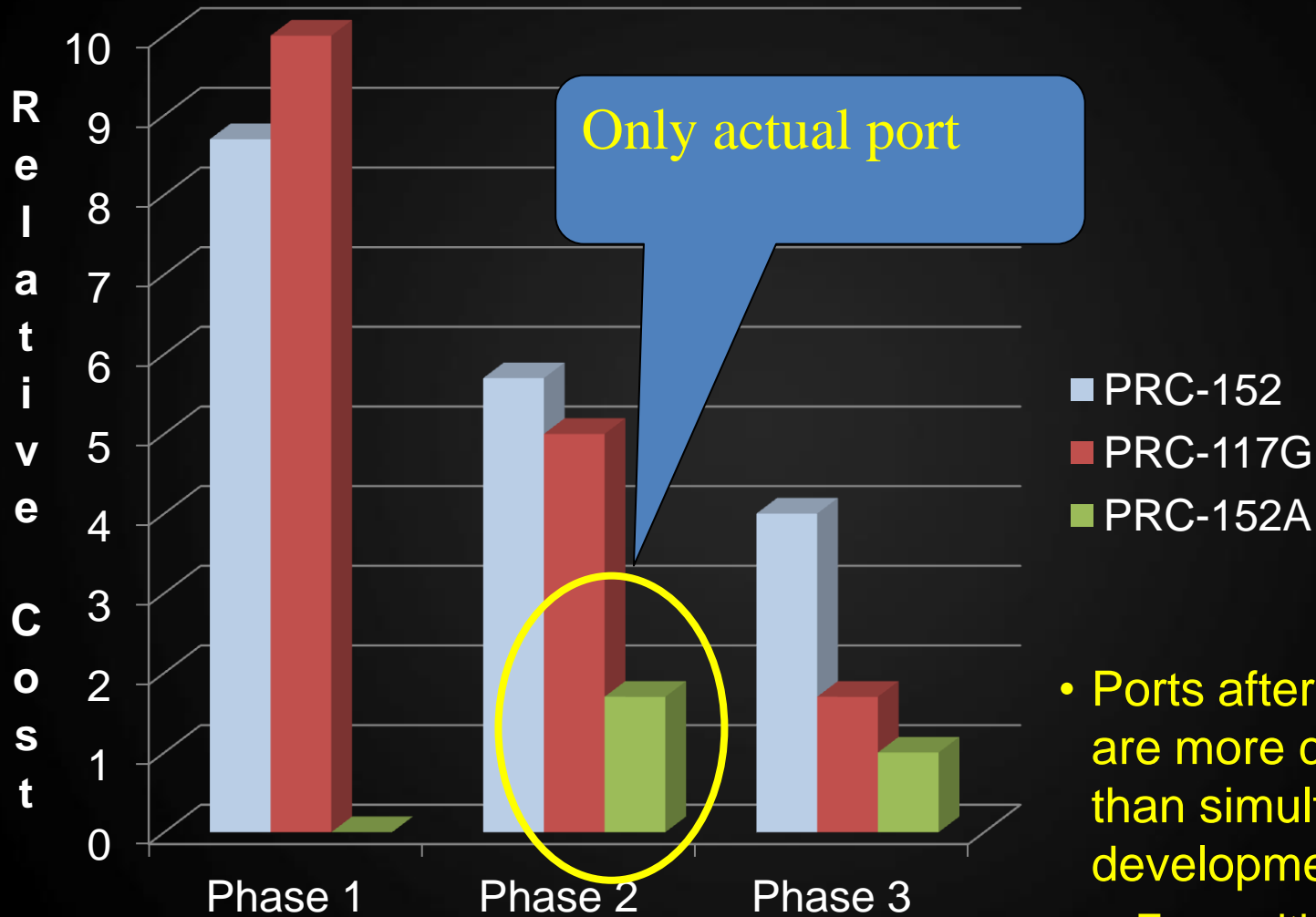
PRC-152 and 117G:

- Phase 1: **Lead with the PRC-117G**, followed with the PRC-152.
- Phase 2: **Lead with the PRC-152**, followed with the PRC-117G
- Phase 3: **Lead with the PRC-152**, followed with the PRC-117G

PRC-152A:

- Phase 1 and 2 **ported after completed** on PRC-117G and PRC-152
- Phase 3: **Followed PRC-152**
- Parallel development and delivery for all phases except PRC-152A Phase 1 and Phase 2
- Same team responsible for development on all radios

Example 2: Native WF Development

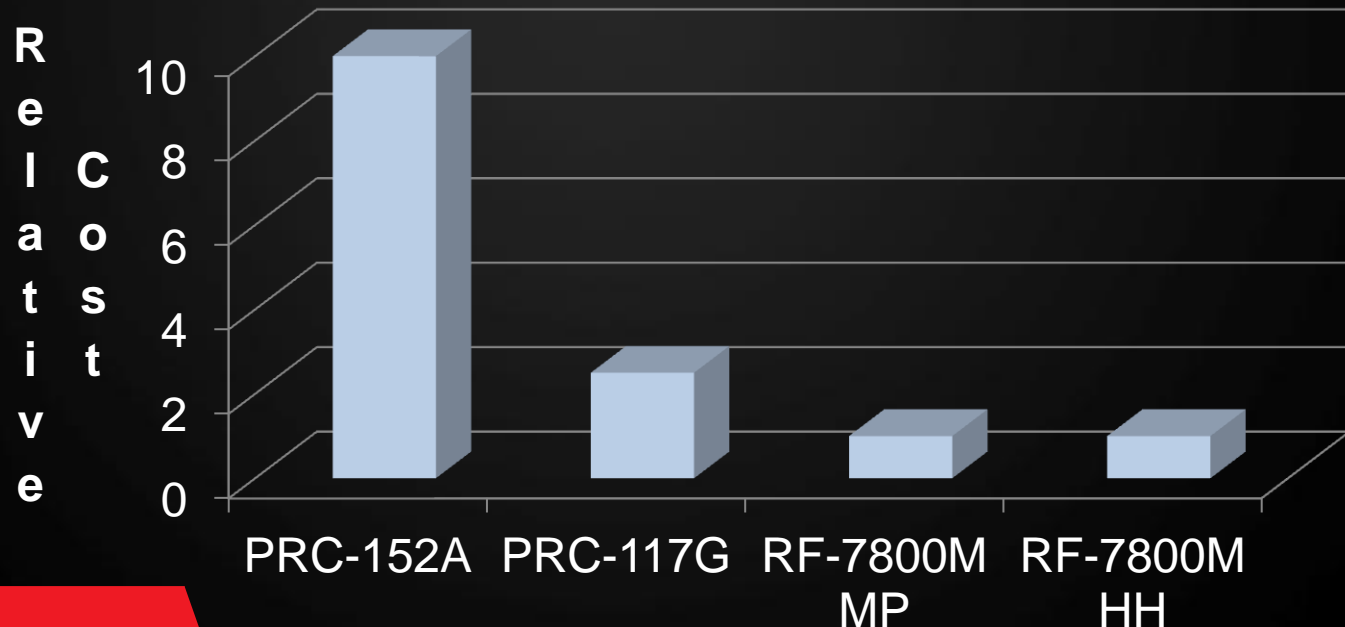


- Ports after completion are more cost effective than simultaneous development
 - Even with a leader/follow paradigm

Example 3: SCA 2.2.2 Upgrade



- SCA 2.2.2 originally implemented in the AN/PRC-152A
- Subsequently ported to the AN/PRC-117G
 - Costs for 152A and 117G are labor only (no certification fees) but do include preparation and on-site support at the JTeL
- Effort for RF-7800M-MP and RF-7800M-HH little more than build and verify
 - Due to highly similar Digital and SW Component architecture cost was 10% of original effort





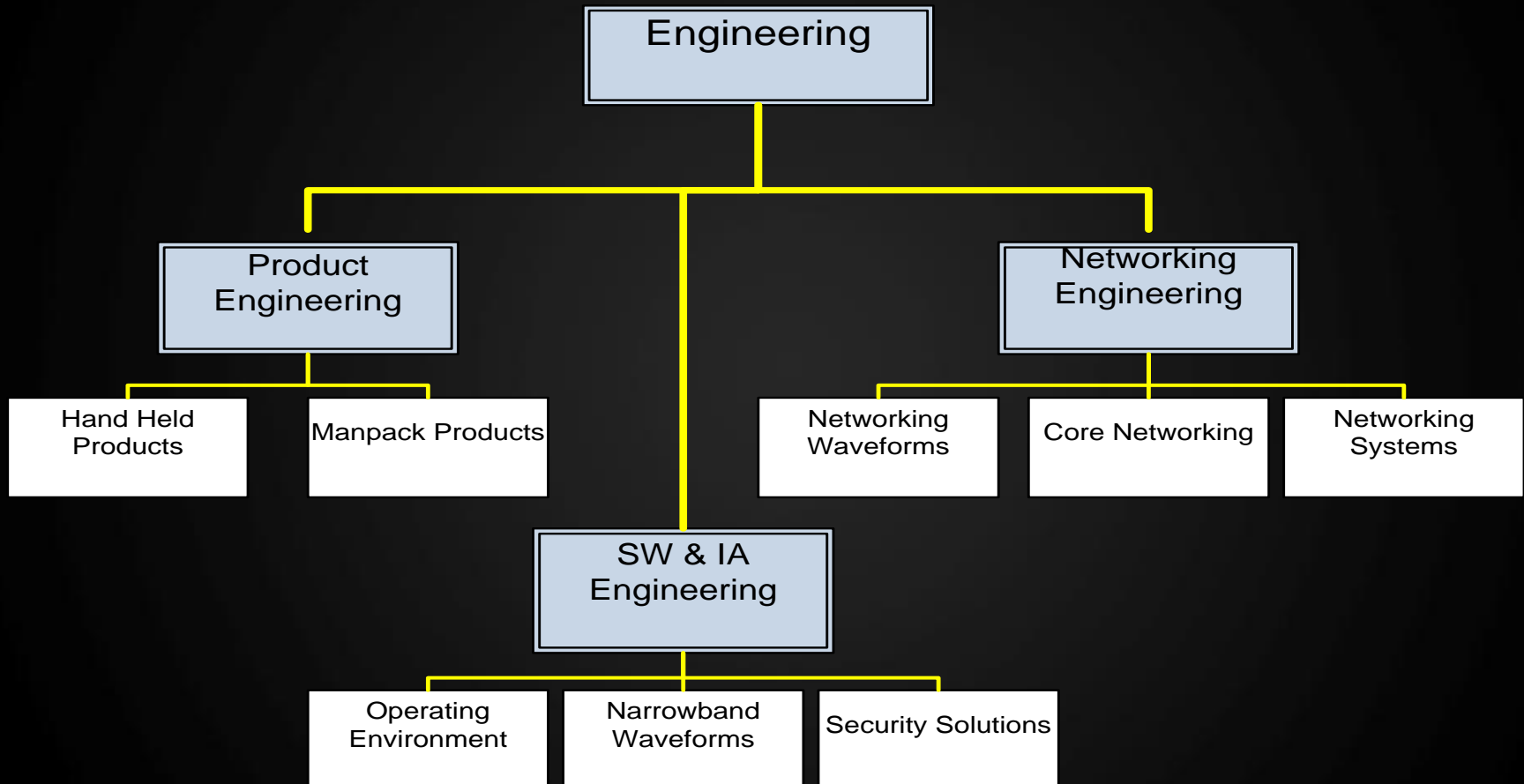
Aspects of Reuse

- Organizational Structure
 - SW Architecture will mirror the Organizational Structure
- Requirements, Design
- Software Development Process
- Test Procedures and Equipment
- Configuration Management

- Significant re-factoring of Applications for integration into multiple products.
 - Software not designed specifically for aggregate levels of reuse.
 - HW changes
 - Non-standard interfaces
- Software technology evolution happens in ad-hoc manner adding risk to project execution.
- Software testing requires significant investment in labor and time even with current levels of automation
 - Growing number of products, multiple releases; increasing number of capabilities and complexity (i.e., networking).
- Not leveraging full breadth of engineering leadership.
- Project execution impacted by constant churn in requirements and direction.
- No ability to develop core technologies or supporting systems outside of product development funding

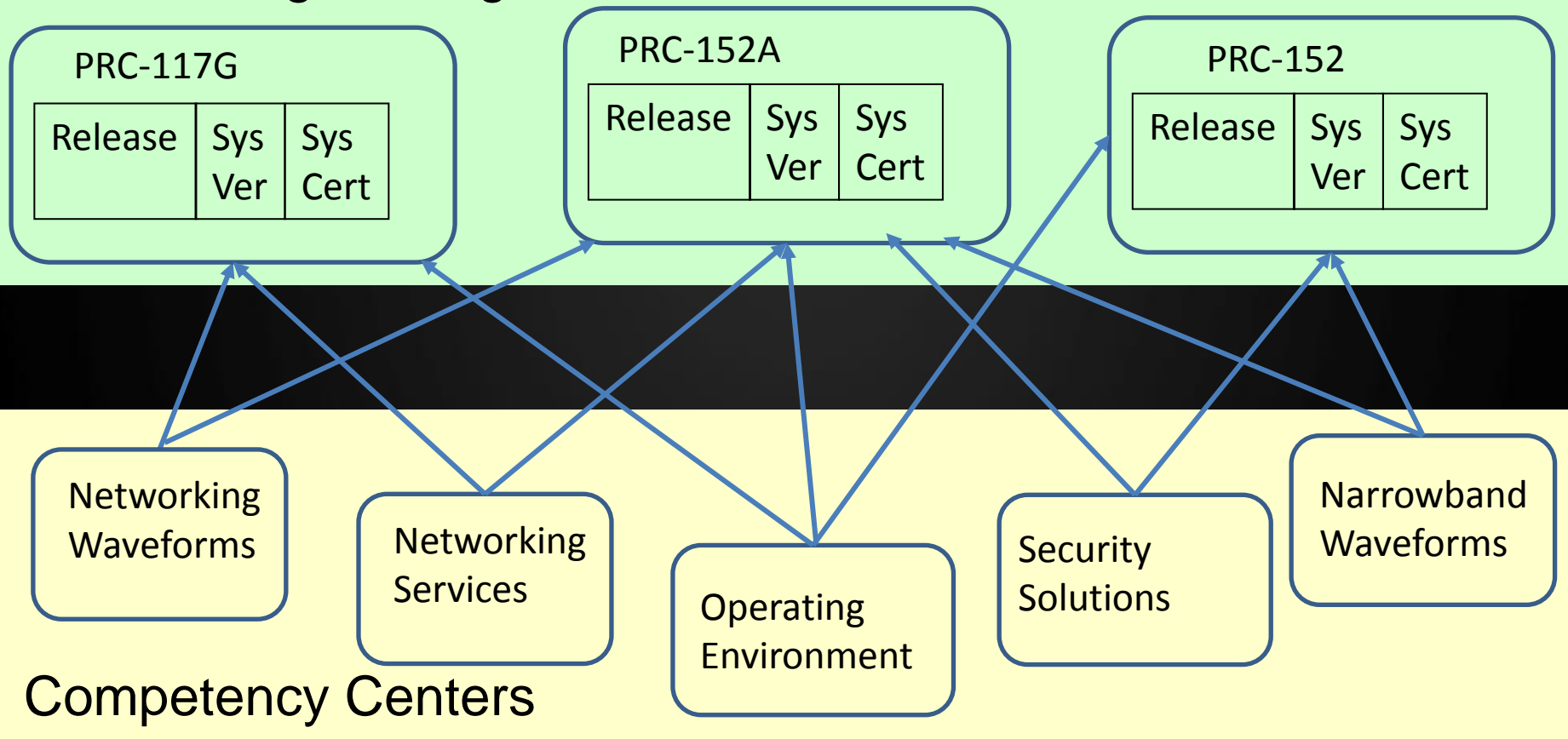
- Reuse models/ architecture roadmap driven by SW Technology WG and aligned with product plans.
 - Planned approach for technology evaluation and insertion
 - Inclusive participation across engineering organizations; SW Engineering organization, platform organizations.
- Increase focus of SW practitioners on development of new features and capabilities, provide business differentiators.
 - Less effort on porting and re-factoring existing SW applications.
- Increase efficiency and quality of software testing
 - More testing automation (includes QTs and upstream processes).
- Focused project execution

- Representative Organizational Structure



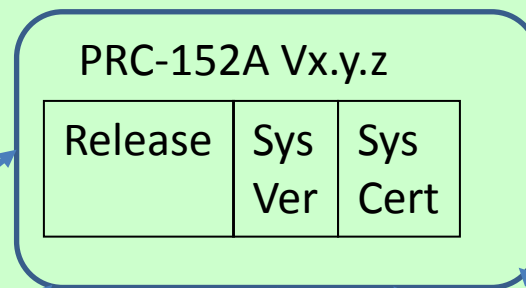
- Project Management Structure

Product Engineering



- Project Management Structure

Product Engineering



ANW2

SRW

Core Network

CF, Devices, Services

Crypto Subsystem

IW

VULOS

Networking Waveforms

Networking Services

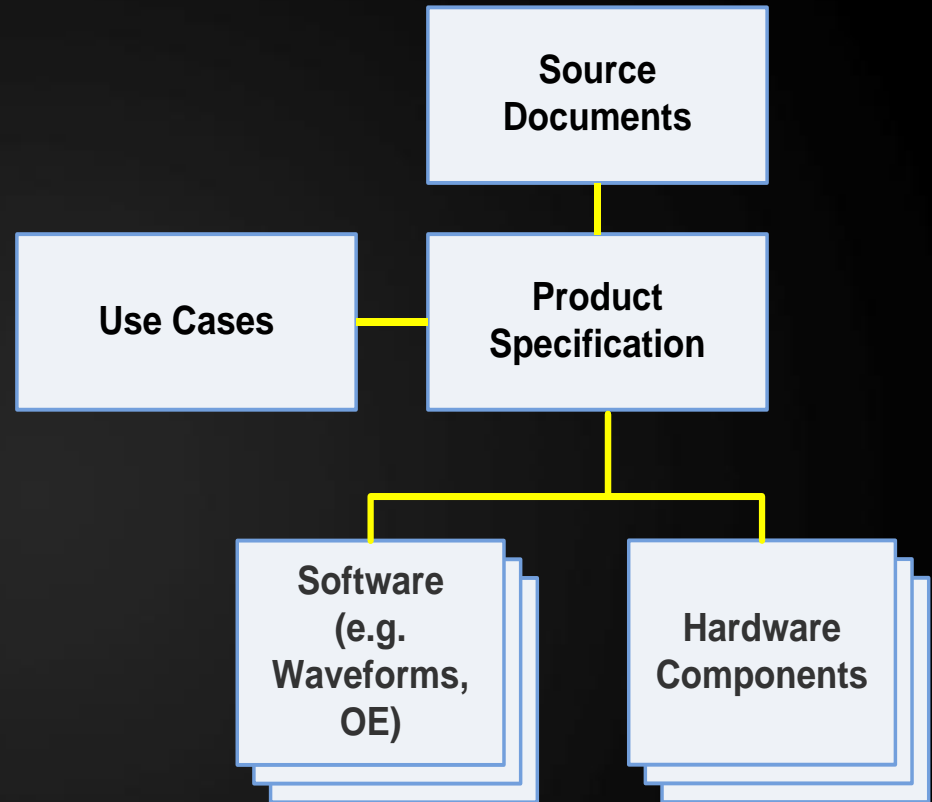
Operating Environment

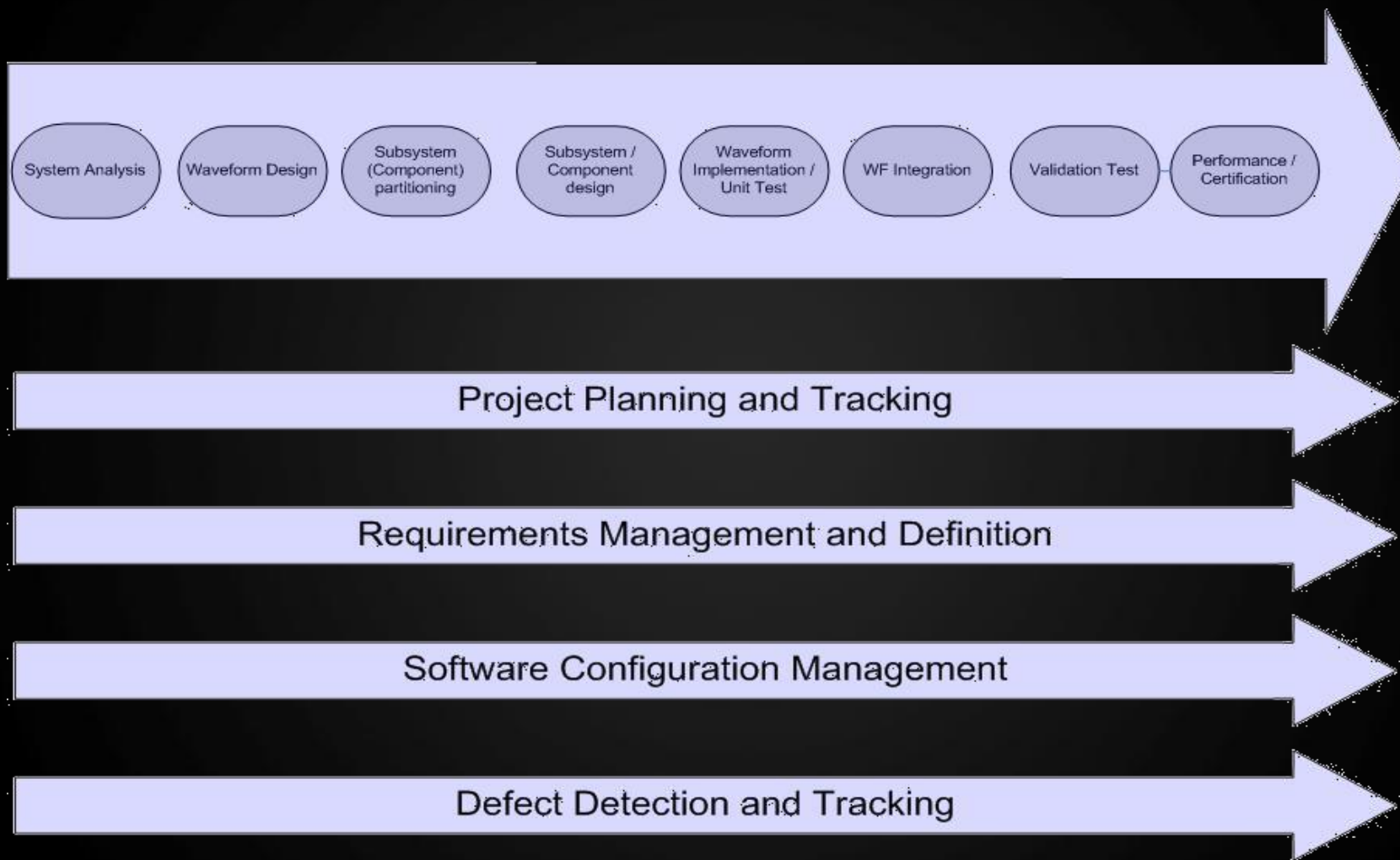
Security Solutions

Narrowband Waveforms

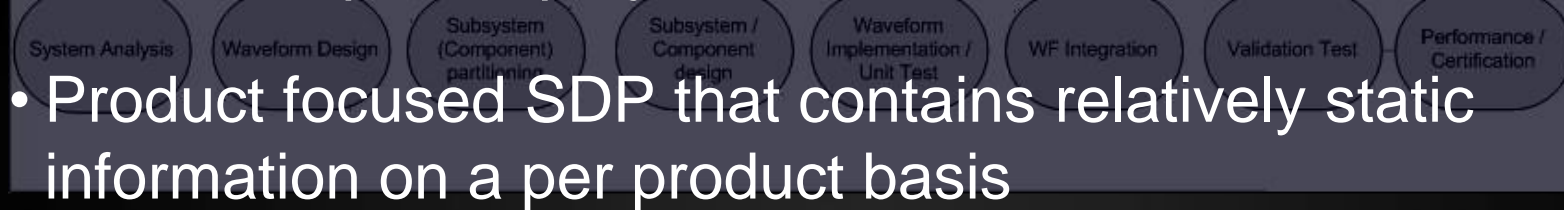
Application Projects

- Requirements tagged/linked for product/version they are included in
- Requirements organized by SPCI
 - Individual requirements flagged as necessary for product based differentiation
- Common ‘building block’ structure for all SPCI’s enables reuse and reduced learning curve





- Common SW Development Process utilized across all FIII development projects



- Product focused SDP that contains relatively static information on a per product basis
- SW project plans that contain dynamic information that changes from one SW or release project to another
- Common toolsets and work flows for Inspections, Trouble Reports, Estimation, Design and Requirements Management

Project Planning and Tracking

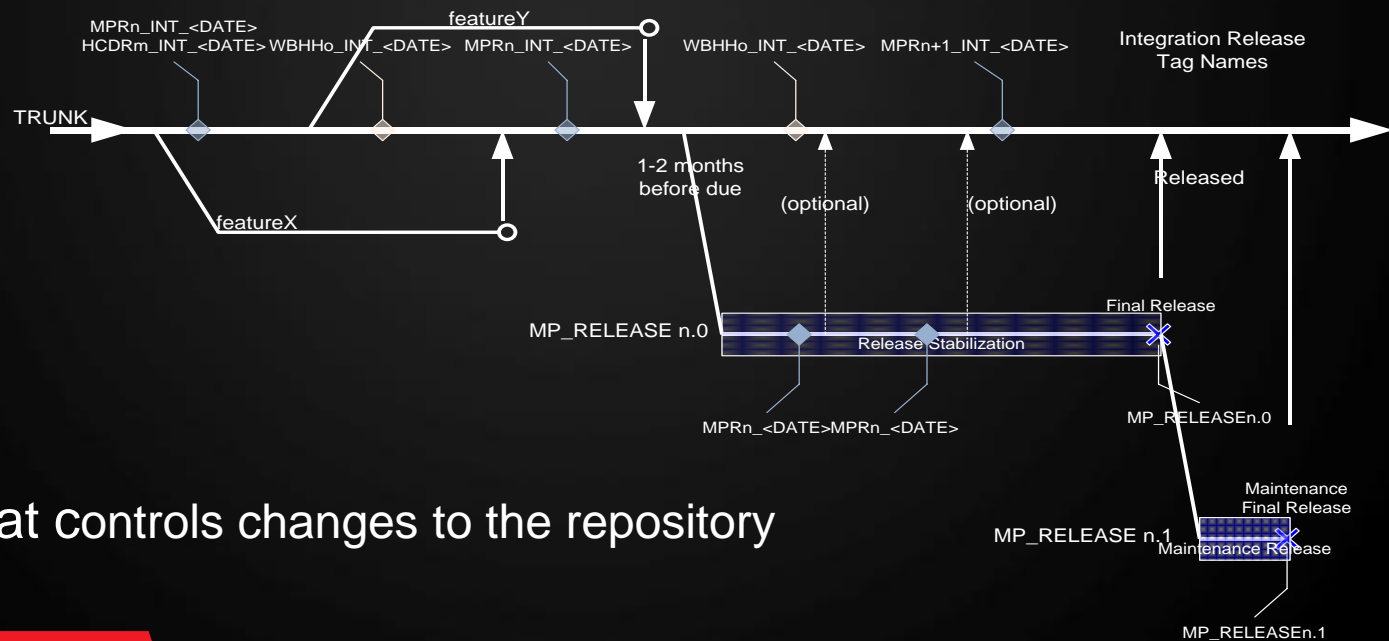
Software Configuration Management

Defect Detection and Tracking

- Common External interfaces from all FIII radios supports re-use of test automation procedures
 - Nightly build verification
- Test cases stored in DOORs
 - Linked to requirements to ensure common test procedure utilized across platforms
 - All levels of test from requirements verification Qualification Tests to Use Case Validation Scenario Tests
- Multi-Purpose Networking Test Fixture
 - Supports Manpack and Handheld radios
 - Can be used for both ANW2 and SRW
- Common Test execution Framework
 - Common environment for scripting and auto-generation of reports

- Common Trunk

- Single repository that contains SW for 5 different radio
 - 2 Manpacks, 3 Handhelds
 - 3 DoD, 2 International
- Build practices
 - Build unique feature sets (products) through use of flags based on product line



- SCCB that controls changes to the repository



Conclusions

- Strive for re-use in all work products
- Commonality of Development Process and Best Practices reduces learning curve and enables swift movement of engineers between projects
- Reuse is hard to achieve at the macro level
 - Opportunities for re-use greatly enhanced by common baseband architecture
- Competency centric organizational structure enables environment for maximizing re-use

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