Ericsson´s 10 Years Of Experiences Of Developing Complex Embedded Real-time Systems Using Model Driven Development And The Way Forward

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The presentation

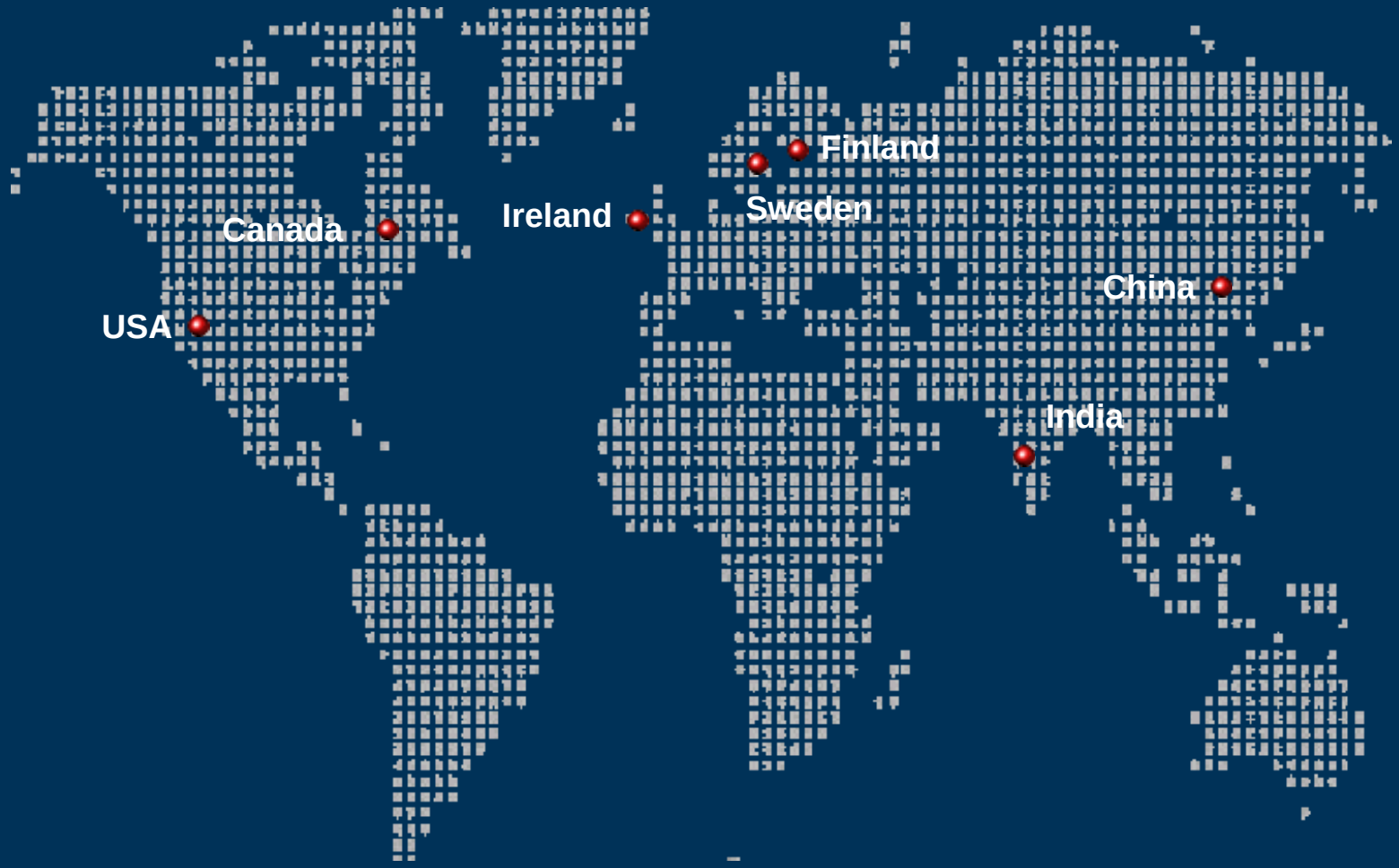
3G History

Lessons learnt

Forward

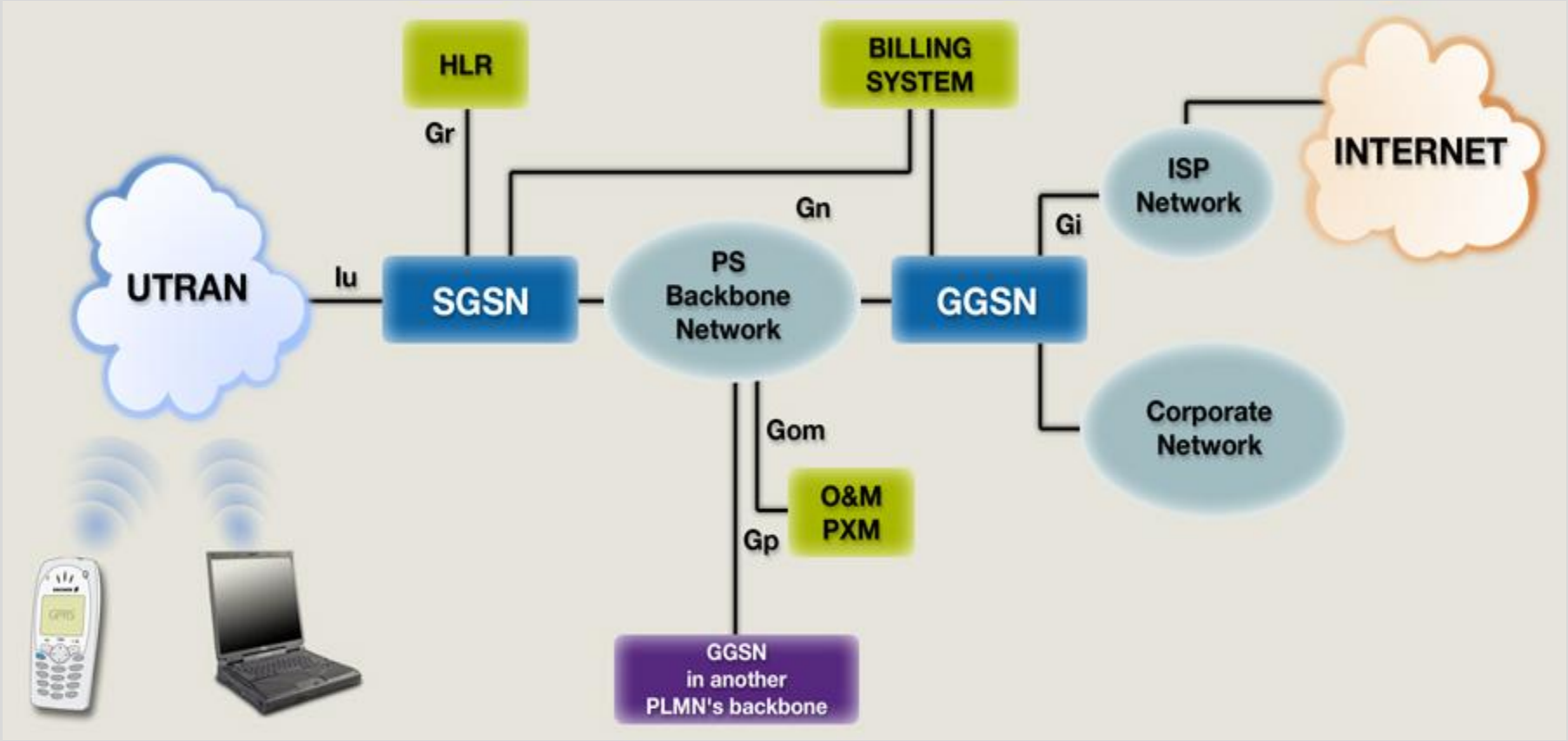

3G History

3G organization around the world

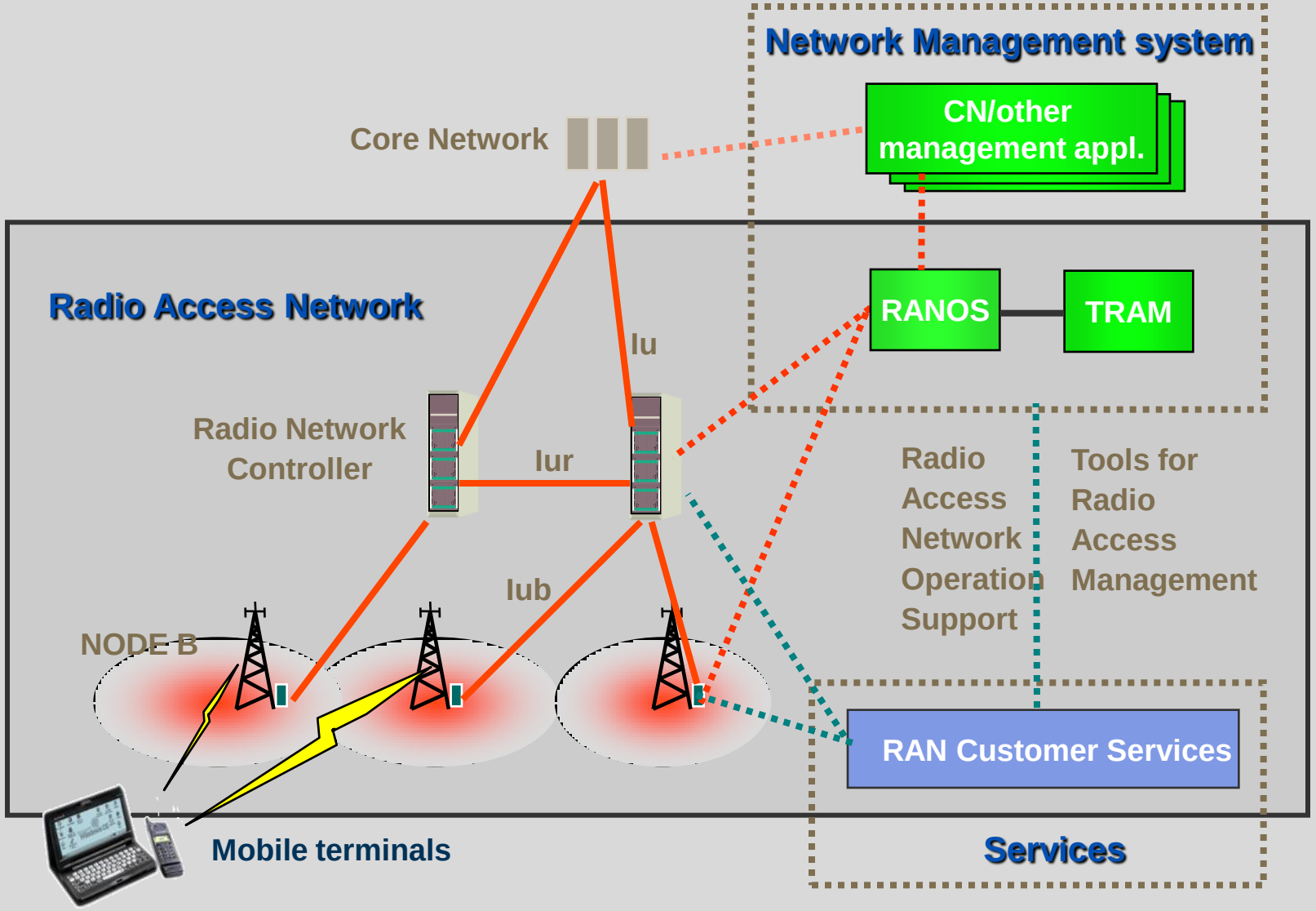


Our Operators

WCDMA Core Network



WCDMA UTRAN


Network Management system
CN/other management appl.
Core Network
Radio Access Network
RANOS
TRAM
Iu
Radio Network Controller
Iur
Radio Access Network Operation Support
Tools for Radio Access Management
Iub
NODE B
RAN Customer Services
Mobile terminals
Services

Development of 3G

3G system started as a test system with different SW development techniques

Strategic decision to move from traditional way of building systems

The first commercial systems where code generated with OTD (Object Time Developer)

OTD was used as main design tool until 2000

Last system developed with OTD where changed out 2006

Development of 3G

Latest projects are developed with RoseRT

Will be in service for 10+ years

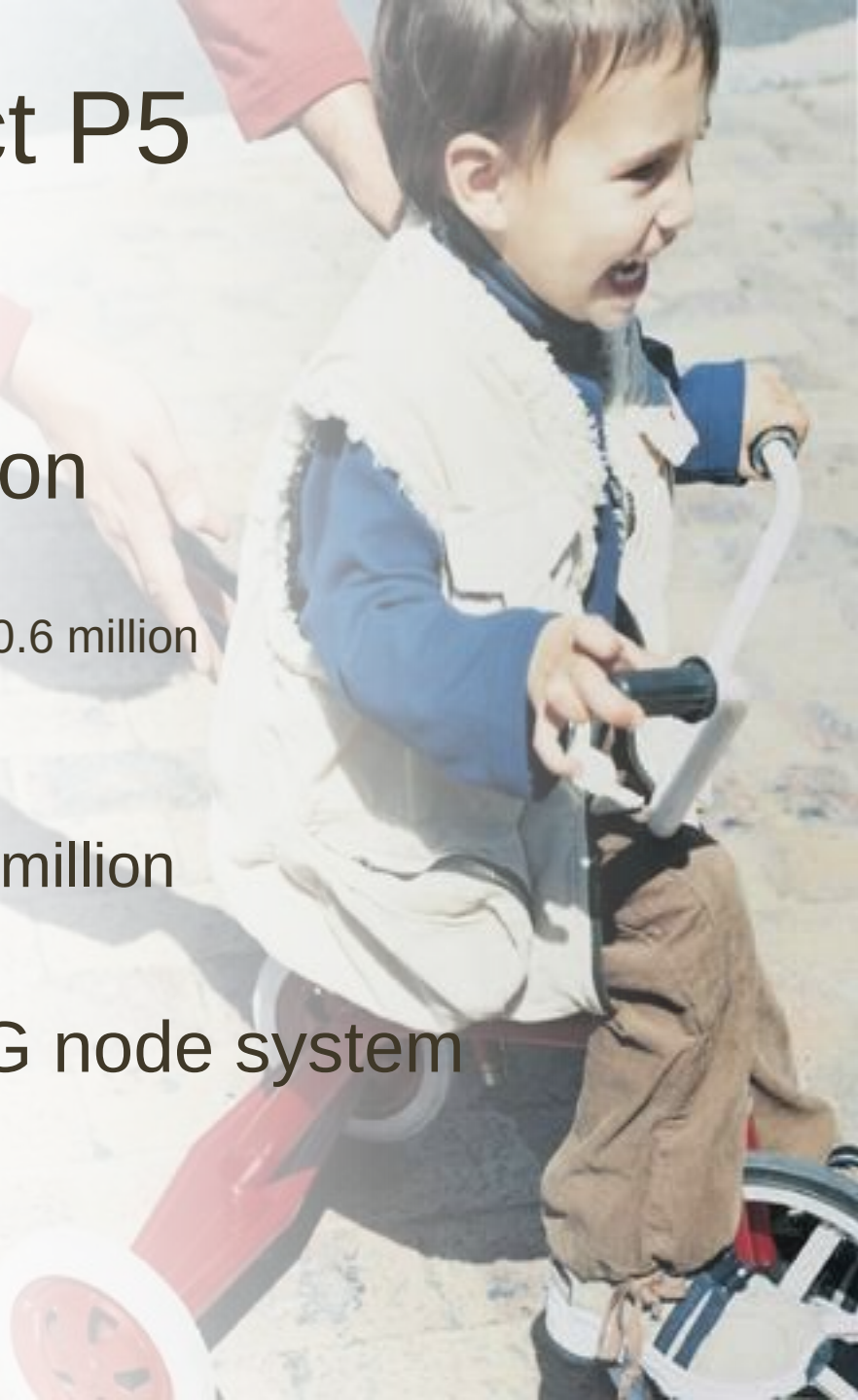
Main feature in P4 (2005) was HSPDA. Rolled out to mass marked 2006

In P5 we developed approx 100 customer features and are now deployed around the globe

The change from OTD to RoseRT where a jump in both modern way of modelling and modelling tools but also a bost in productivity

Some facts in project P5

(3G-node)



Generated RRT 2,4 million

Written RRT 0.6 million

Written C++ 2.0 million

Written Java 0.2 million

~60.000 signals /second in 3G node system

Project P5

Live Networks Fully Rolled out on P5 SW

over 100 Customers served

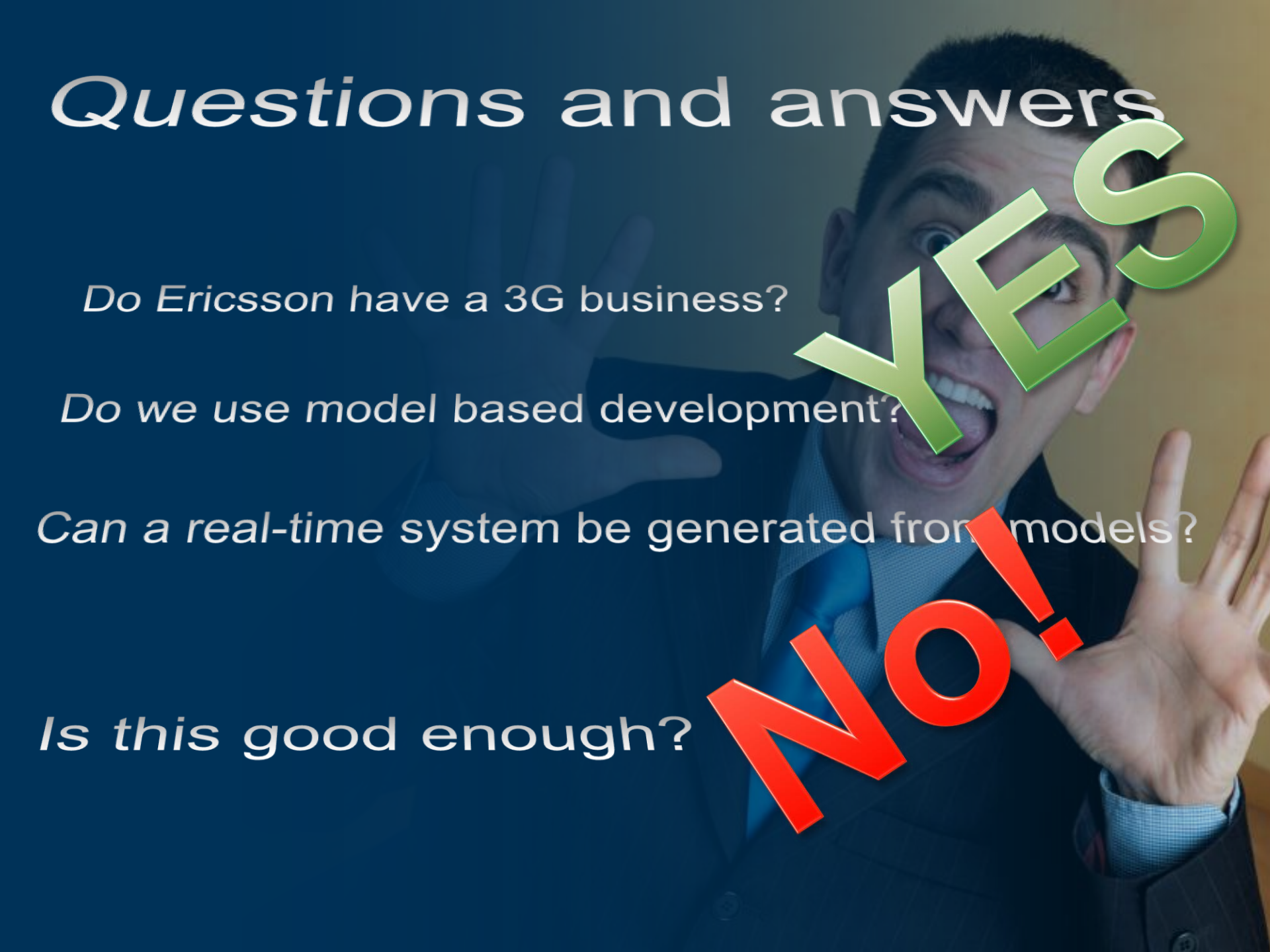
P5 was rolled out to all customers within 12 Months

Ten thousands of 3G nodes

1 NW / Country 2 or more NW / Country


Lessons learnt
Changed way of working
Use cases and use case selection
Guidelines & courses beneficial
Core modeling and architecture team
Tool & Configuration Management support
Mind shift

Questions and answers



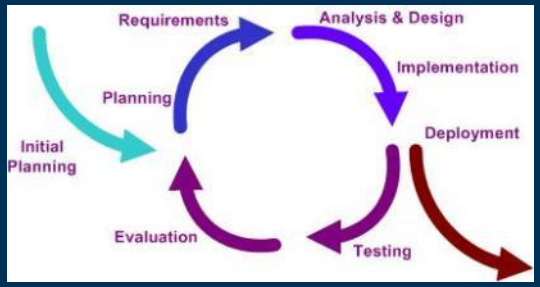
Do Ericsson have a 3G business?

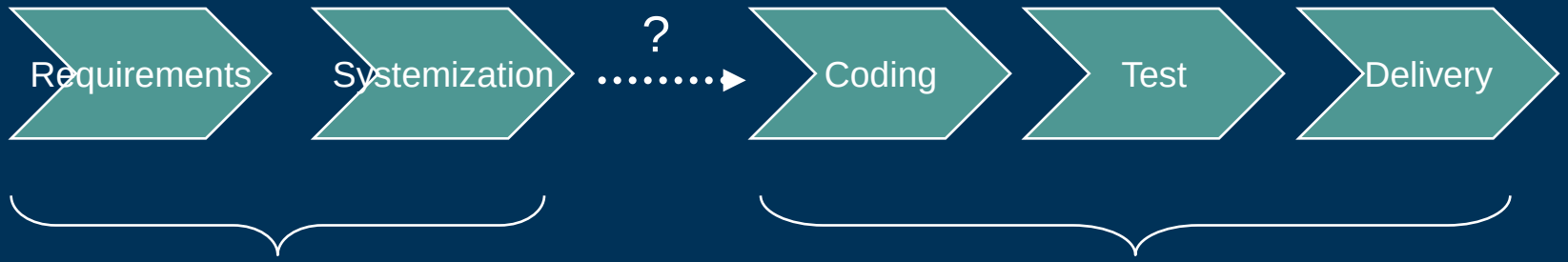
Do we use model based development?

Can a real-time system be generated from models?

Is this good enough?

Focus areas until now





Modeling on a high level but still major part is document driven

One-Track, ICE, SWDI, Streamline Development
Use of modeling tool like OTD and RRT but more like SW compilers

We tend to take small not connected steps and evaluate them without taking account to the big picture

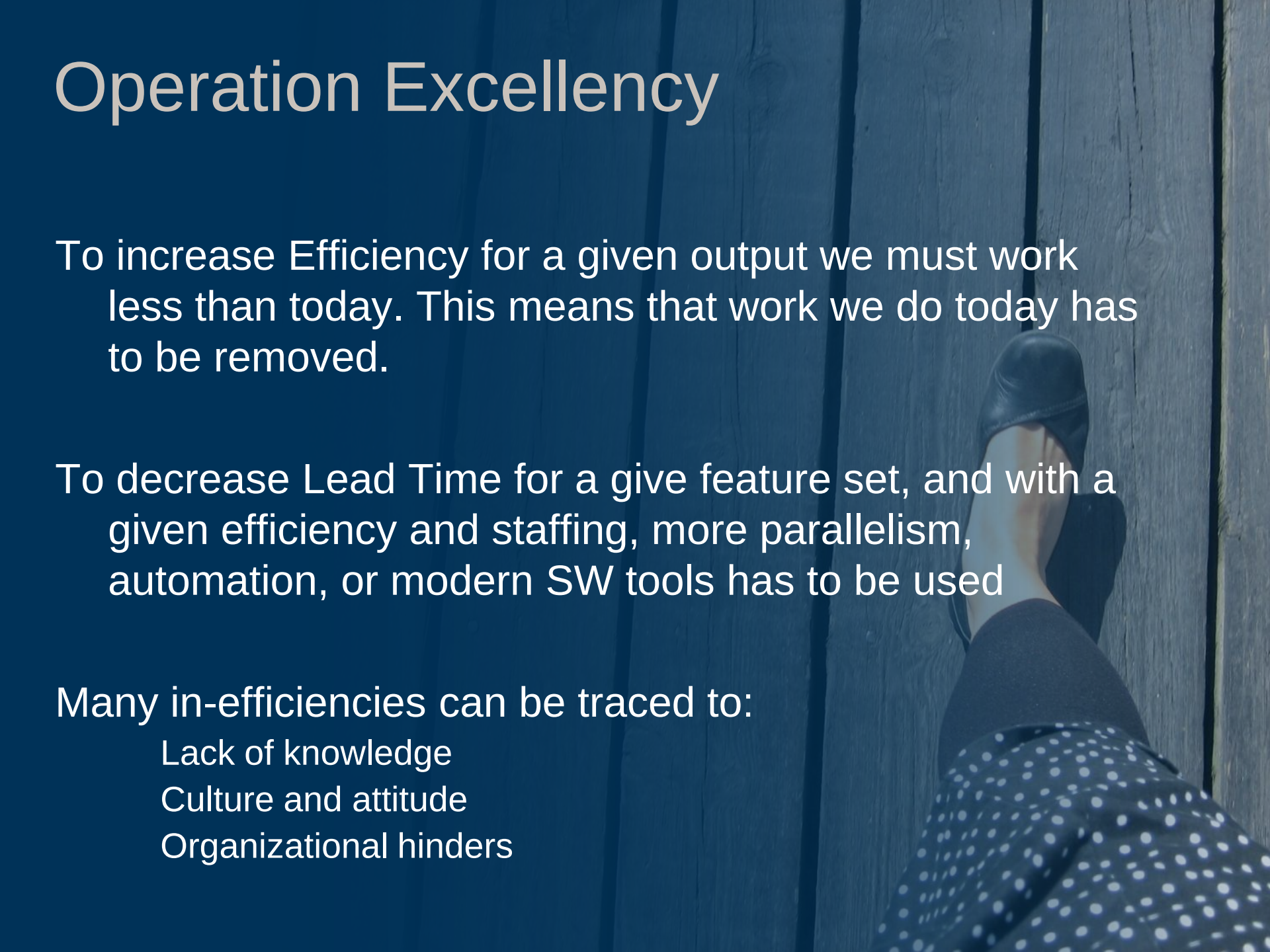
Operation Excellency

To increase Efficiency for a given output we must work less than today. This means that work we do today has to be removed.

To decrease Lead Time for a give feature set, and with a given efficiency and staffing, more parallelism, automation, or modern SW tools has to be used

Many in-efficiencies can be traced to:

- Lack of knowledge
- Culture and attitude
- Organizational hinders



Questions and answers

Do Ericsson have an idea how to work bett

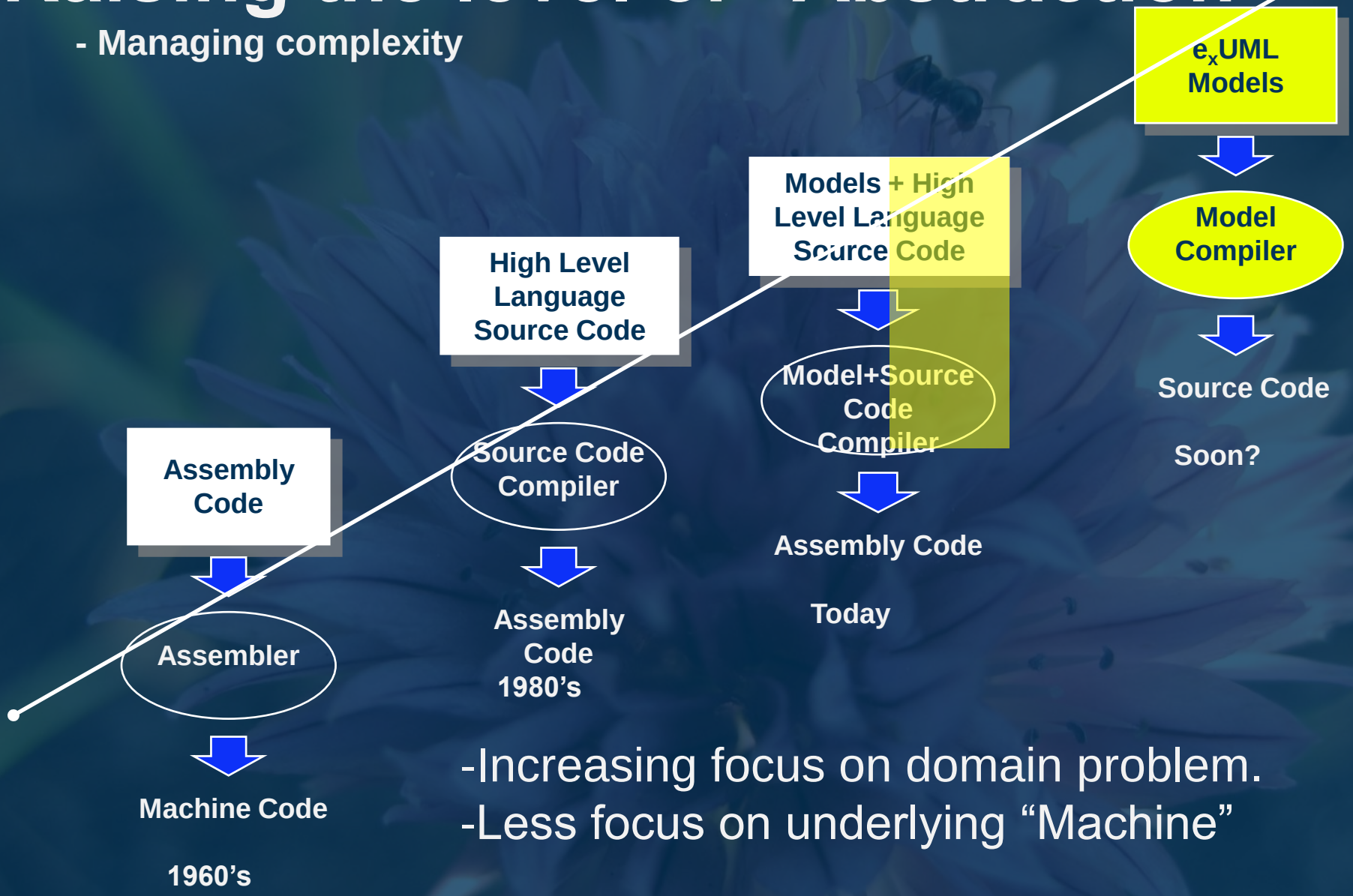
Can we process-vise demonstrate a "r volu on"

Do we have proof from actual productio ?


Forward

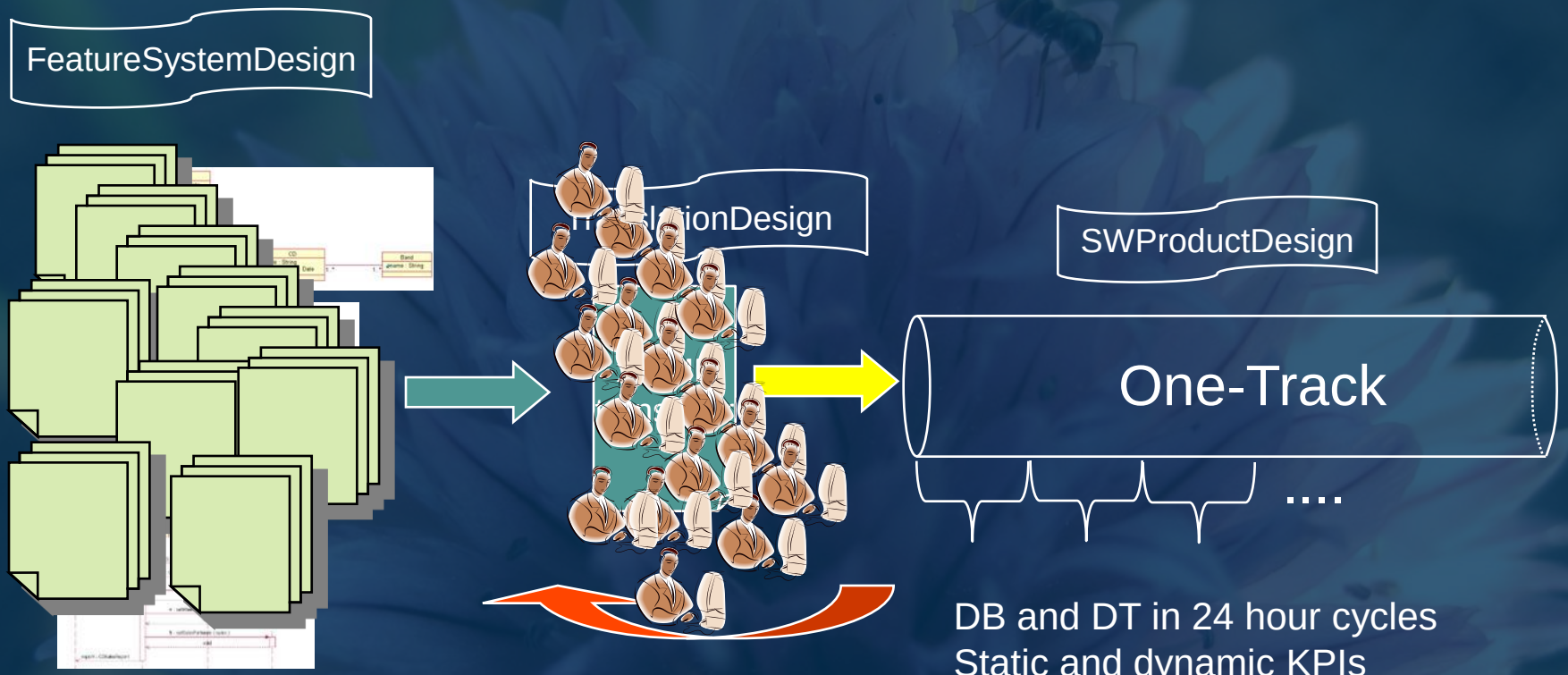
Raising the level of "Abstraction"

- Managing complexity



-Increasing focus on domain problem.
-Less focus on underlying "Machine"

Evolving the way-of-working



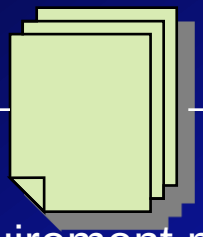
DB and DT in 24 hour cycles
Static and dynamic KPIs

Agile WoW

- We work in cross-functional co-operation
- We design plain and minimal solutions
- We know how scope usually changes
- We plan and develop in small steps
- We can modify scope smoothly
- We integrate changes and additions systematically

Model levels (wanted)

Characteristics and traffic modelling



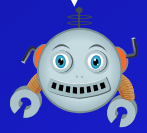
Requirement model

System model

Verify

Test and verification models

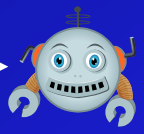
Design model



Automatic Test engine

Implementation model

Possibly also common interface model shared by all



Code

“Radical” Software Process

Design-production-verification

”Creative Innovation”
SysML/UML

Logical model

Automatic translation

xUML Mdl-compiler

”software assembly line”

Ericsson proprietary “One-track/streamline dev chain

Binary executables

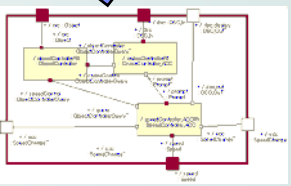
Runtime observation

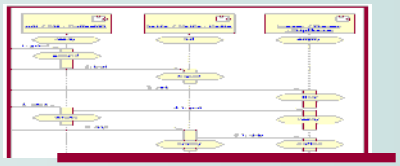
Rules based test & verification

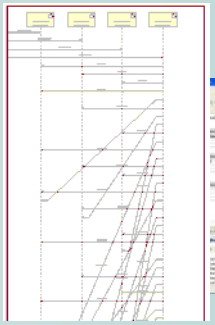
Model Simulation & dbg

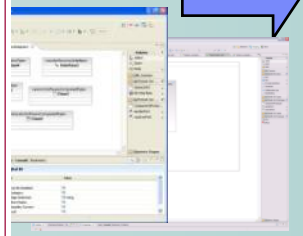
Model understan ding

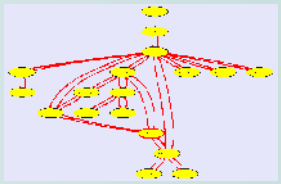
Model refinement

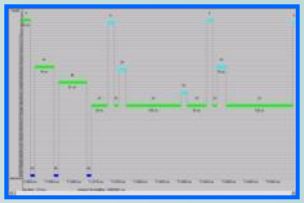












Visual results display

Directions and Trends

Maturity in use of systems modeling

More use of MBT

More use of true MDA style technologies

Multi-Core deployments through the use of MDD

Activity on open source eclipse MDD projects

Use of DSL's

Better competence and information exchange

Summary

- The majority of software for our 3G systems has been designed using Rose-RT
- We have more than ten million lines of C++ code designed using Rose-RT (several thousand man years)
- Some key Ericsson 3G ”players” state that ”...without modeling, we wouldn’t have had the market advantage we have...”
- These systems are evolving rapidly, large volumes of new functionality is being implemented
- Ericsson has a way forward to be even more efficient and productive

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