

## Integration Centric Development and Anatomies

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### Outline

- Why Integrated Centric Development (ICD)?
- What is ICD?
- How do you realize it?
- Experiences from Ericsson
- Summary and discussion

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## Why ICD?

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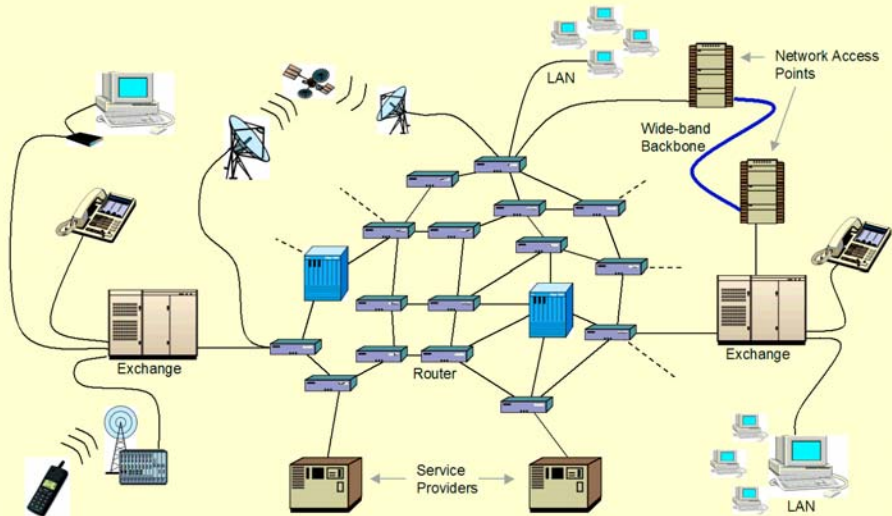
## The big challenge

*"The **total technical changes** being implemented in this project **are enormous**. Such changes are needed in order for Ericsson to get a world-leading product first to market. Using **traditional methods** then the scope of change implemented in single steps will be too large and **can not be managed**."*

Keith Dyne, total project manager 3G, Ericsson,  
Dec 1999

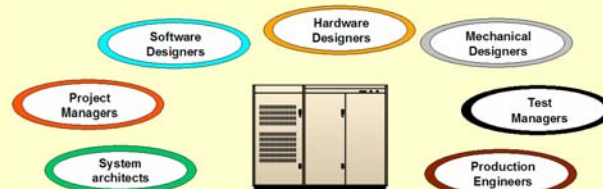
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## A telecom network



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## Complexity in system development



### Drivers

- Market push
- Shorter time to market
- More competitors
- Less margins
- Shorter product life cycles
- Technological complexity
- Standardization
- Change

### Emphasis on

- Development lead-times
- Coordination and dependencies
- Progress follow-up
- Culture - disciplines
- Geographical distribution
- Commitments and responsibilities
- Competence
- Quality

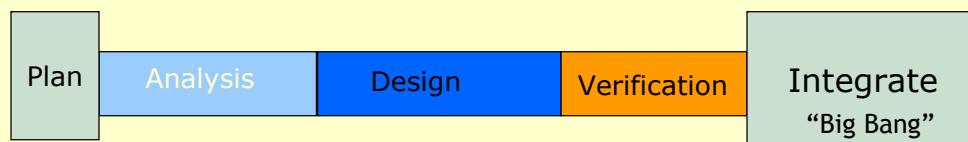
Integration Centric Development

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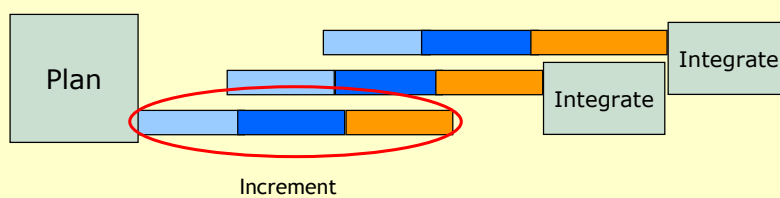
## What is ICD?

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### From waterfall to incremental development



- Divide the work in small controllable parts - Increments)
- Increments must be testable parts of the system



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## Definition of Integration Centric Development

To plan, verify, produce, install and industrialize  
**in the same order** as the completed system **is started up**

- System integration as soon as possible
- Utilize parallelism as much as possible
- Focus on dependencies
- Something more than incremental development!

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## Guidelines

- Everybody works from the same image of the system
  - same view, same plan
- Everyone gets access to the same information simultaneously
- Everyone is responsible for their contribution
- “Soft Entries, but Hard Exits”
- High moral
- Decisions are focused on the final target

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## The anatomy - the basic construct in ICD

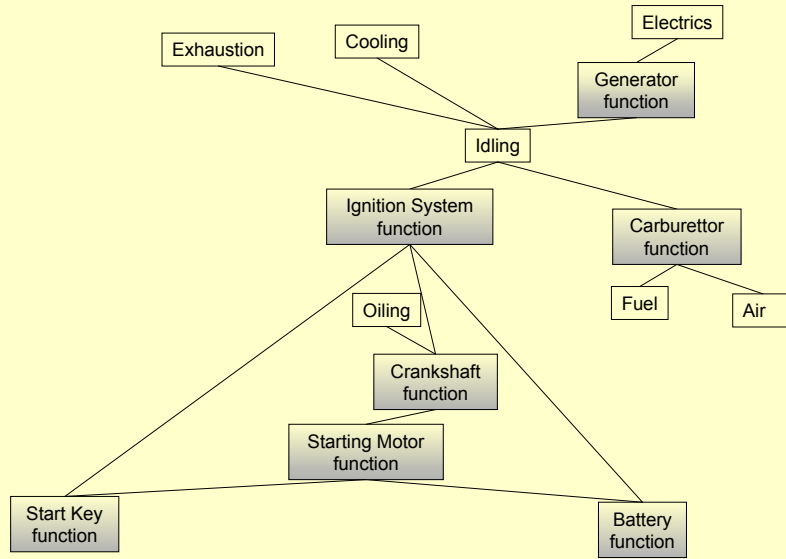
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### The anatomy

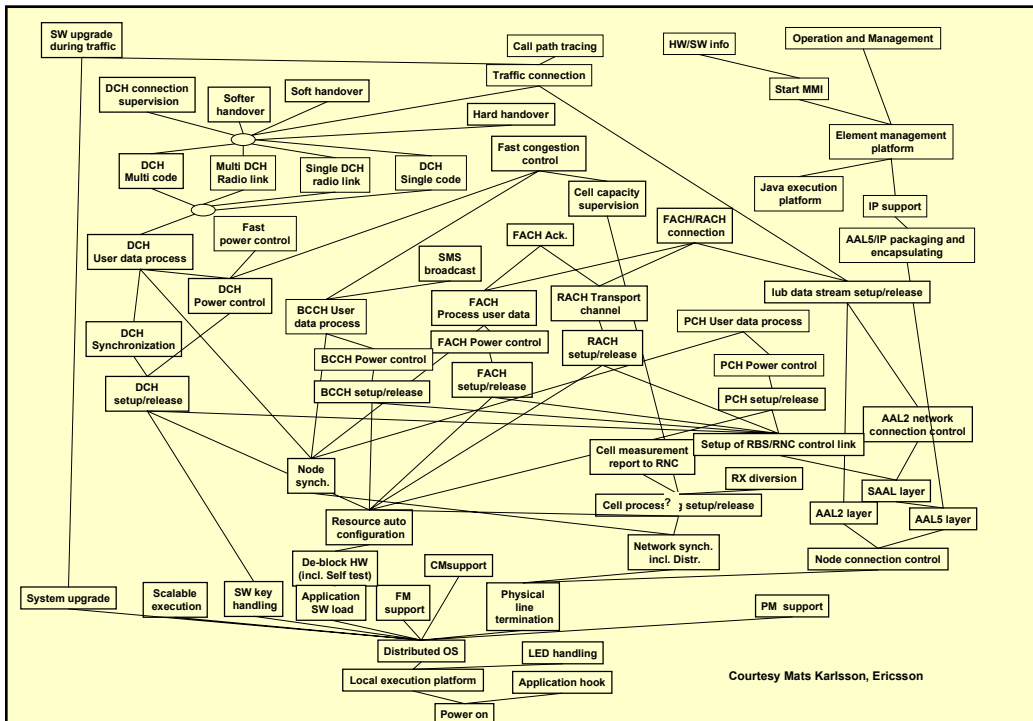
- Shows the logical order and dependencies between functions when you start up the system
  - How to 'breath-life-in-a-system'
- Mindset: If you "power-on" what happen then and then..
  - Repeat the question until you reach the end functionality
- What can be seen from the "outside"
  - Functions that works in the system
- Not implementation dependable
  - More architectural view
- The functions in an anatomy turns out sometimes not to be the same as the functional specifications

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# Anatomy of a Car Engine (Otto)



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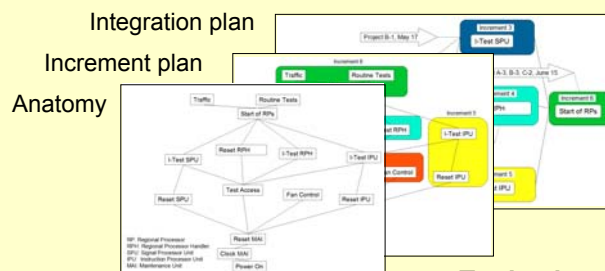


## Realization of ICD

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## A method and tool support

### Method - understanding



### Tools - integration management

ADM-Workpackage Overview

Created 2008-05-04 16:12:28 by jacob.roland

Object	Package	Name	Planned Start Date	Planned Ready for Start	Planned Ready for Start	Planned Ready for Start	Ready for Start	Ready for Start	Ready for Start	WIP	Responsible	Owner
Work Package	AD4	RFLZY	2008-5-13	2008-6-20	2008-6-24	2008-6-7	2008-6-17	2008-6-17	2008-6-17	0%	ingemar.ingemar	ingemar
Work Package	AD2	RFLZY	2008-5-20	2008-7-14	2008-7-24	2008-6-7	2008-6-27	2008-6-27	2008-6-27	0%	ingemar.ingemar	ingemar
Work Package	AD4	RFLZY	2008-5-27	2008-6-20	2008-6-24	2008-6-7	2008-6-27	2008-6-27	2008-6-27	0%	ingemar.ingemar	ingemar
Work Package	AD2	RFLZY	2008-5-27	2008-7-14	2008-7-24	2008-6-7	2008-6-27	2008-6-27	2008-6-27	0%	ingemar.ingemar	ingemar

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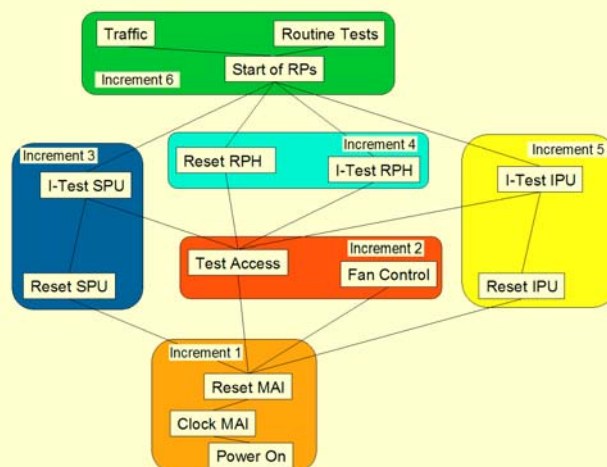
## Anatomy properties

- Describes how the system works - an architectural view
- Everybody has the same view of the whole system
- Shows dependencies and independencies among functions
- Good for educational purposes
- Re-usable
- One page

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## Phase 2 - Increment planning (Architectural View -> Implementation View)

- **Purpose**
  - Define increments that can be developed, verified and integrated as units
- **Focus**
  - Distribution of increments
- **Main actors**
  - System integrators
  - System testers
  - Project managers



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## Integration Plan properties

- Resembles an ordinary project plan
- Describes deliveries, from whom, when
- Describes dependencies between subprojects
- Shows domino effects
- Shows real progress
- Early system integration - early system warning
- Easy to use traffic light color coding to show status
  - Green - On Plan, Yellow - Warning, Red - Off Track

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## You need two types of plans

- Anatomy - based
  - For everyone to understand the system and the status in the project
- Detailed plans on all levels
  - To keep track of the necessary logistics

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## Tool support

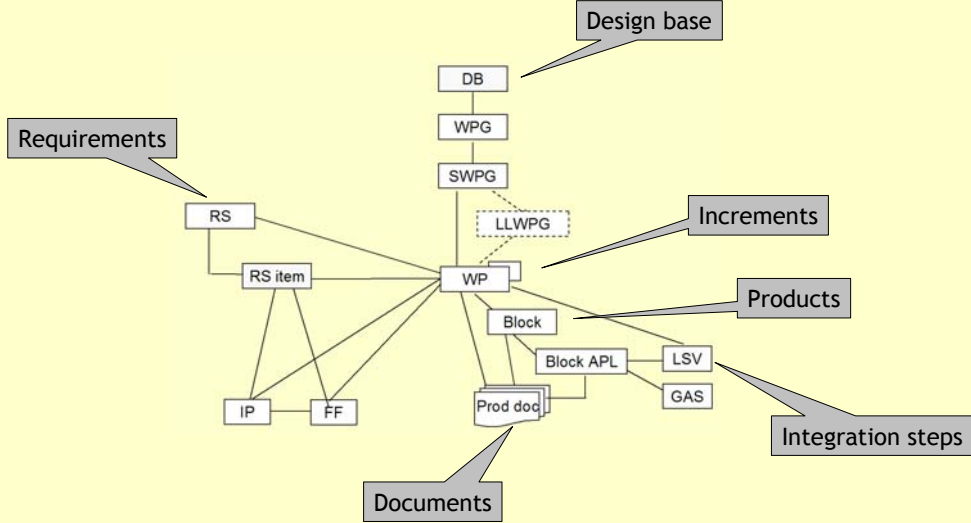
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## Tool support

- **Focus on managing the integration process**
  - Identities, revisions, states, attributes, dependencies, ..
- **Managed items**
  - Anatomy
  - Products and documents
  - Increments
  - Integration steps
  - Requirements
  - Test cases
  - Engineering change orders
  - Error reports
  - Baselines
  - Milestones
  - ...

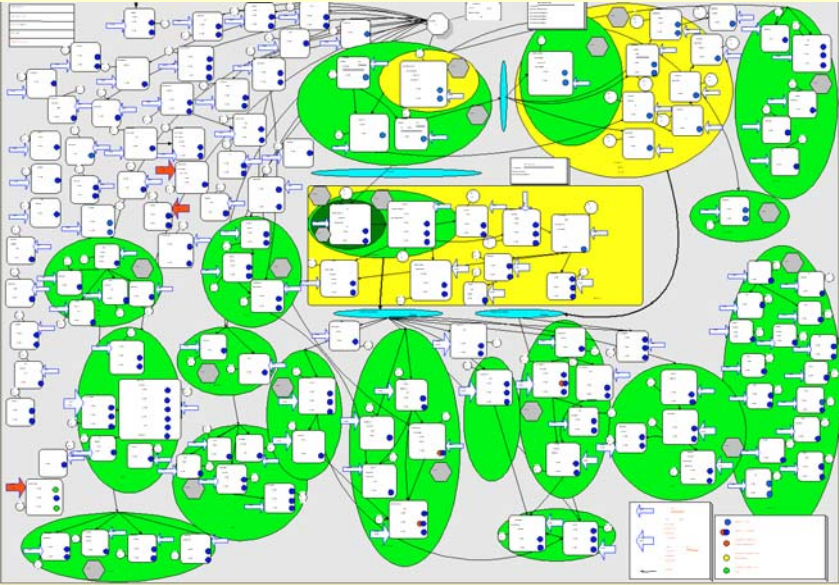
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# Information model - 3G node



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# Integration Plan - Mobile Switching Center Node, 3G



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## Sample report - 1

eMatrix HTML Query - Netscape

File Edit View Go Communicator Help

ADM-Workpackage Overview eMatrix HTML Table Writer

Created 2000-08-04 16.33.28 by Anita Behle

Object	Slogan	State	Planned Start Date	Planned ready date for FT to start	Planned Ready for Joint FT to start	Planned Ready for LSV	Planned Ready Date (MSS)	Ready in Time	LSV Choice	WP Responsible	Owner
Work Package, B08a/02,	BASE - AD4	RFLSV	2000-5-15	2000-6-26	2000-6-26	2000-8-7	2000-9-27	Delayed with no impacts (DNI)	LSV10_CME20 2000-8-7		SP- Harvey: EED
Work Package, B08a/03,	BASE - AD5	RFRLSV	2000-5-29	2000-7-10	2000-7-24	2000-8-7	2000-9-27	Delayed with no impacts (DNI)	LSV10_CME20 2000-8-7		SP- Harvey: EED
Work Package, B08c/02,	BT - AD4	RFLSV	2000-5-2	2000-6-26	2000-6-26	2000-8-7	2000-9-27	Delayed with no impacts (DNI)	LSV10_CME20 2000-8-7		SP- Harvey: EED
Work Package, B08c/03,	BT - AD5	INFT	2000-5-15	2000-7-10	2000-7-10	2000-8-7	2000-9-27	Delayed with impacts (DI)	LSV10_CME20 2000-8-7		SP- Harvey: EED
Work Package, B08d/02,	BR - AD1	RFLSV	2000-3-13	2000-5-15	2000-6-26	2000-8-7	2000-9-27	Delayed with impacts (DI)	LSV10_CME20 2000-8-7		SP- Harvey: EED

Document: Done

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## Sample report - 2

eMatrix HTML Query - Netscape

File Edit View Go Communicator Help

ADM-Workpackage Relationships eMatrix HTML Table Writer

Created 2000-08-04 16.34.17 by Anita Behle

Object	Slogan	Dependent WPs	Connected Blocks	sWPG	IPs	Owner
Work Package, B08a/02,	BASE - AD4	B08a/03, B08b/01, F03a/01, C06b/01	BEACC	B08a	189/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08a/03,	BASE - AD5	ContainerWP - LSV10 EED-Harvey, B08b/01, F03a/01	BEACC	B08a	189/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08c/02,	BT - AD4	B08c/03, B08b/01, F03a/01	BTAAL2, BTCM, BTDA	B08c	187/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08c/03,	BT - AD5	B08c/04, B08b/01, F03a/01	BTAAL2, BTCM	B08c	187/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08d/01,	BR - AD1	B08d/02	TRAREB	B08d	67/159 41-2/FCPW 101 28, 121/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08d/02,	BR - AD3	B08d/03	ANDP, BADA, DA, RA, RODA	B08d	67/159 41-2/FCPW 101 28, 121/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08d/03,	BR - AD4	B08d/04, B08b/01, F03a/01	ANFH, TRACO, TRAREB, TRACOB	B08d	67/159 41-2/FCPW 101 28, 121/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, B08d/04,	BR - AD5	B08d/05, B08b/01, F03a/01	TRAREB	B08d	67/159 41-2/FCPW 101 28, 121/159 41-2/FCPW 101 28	SP- Harvey: EED
Work Package, C04a/02,	SSF Charging Adaptation to OIP and PCDSE. Rest of TTS & M & sanitation	C04a/01	SHCHM	C04a	131/159 41-2/FCPW 101 28, 185/159 41-2/FCPW 101 28	SP- CHS: LMF

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## Experiences from Ericsson

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### Project data

- **Develop a new central processor for the main Ericsson switching system, the AXE system**
  - The first central processor was developed in the early 70s
- **Schedule to 1995-1997 (ended in 99)**
- **7 major projects**
- **About 300 people at its peak**

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## Challenges

- **New hardware**
  - New real-time ASIC (one miss - 3 months delay)
  - New memories
- **New software**
- **Capacity increase**
  - 4 times
- **Geographically dispersed**
  - Developing centers in Sweden, Germany and Australia

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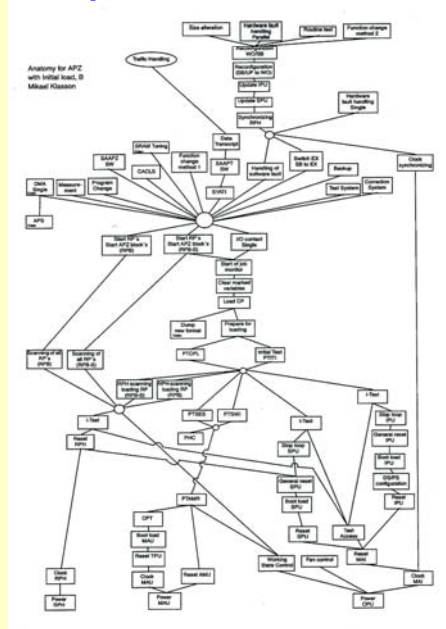
## Delays

- **New key managers came in 1997**
  - The project was late
  - No control over project status or what should be done
  - Problems with functionality
- **Some new managers had experience from previous project that used the anatomy approach**
  - Decided to try the anatomy approach



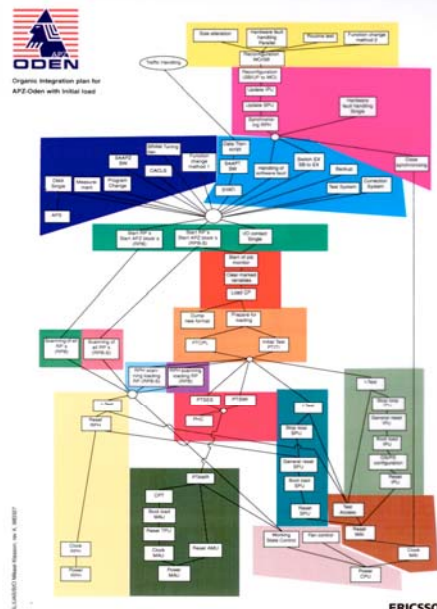
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## Anatomy - APZ processor ODEN, Ericsson



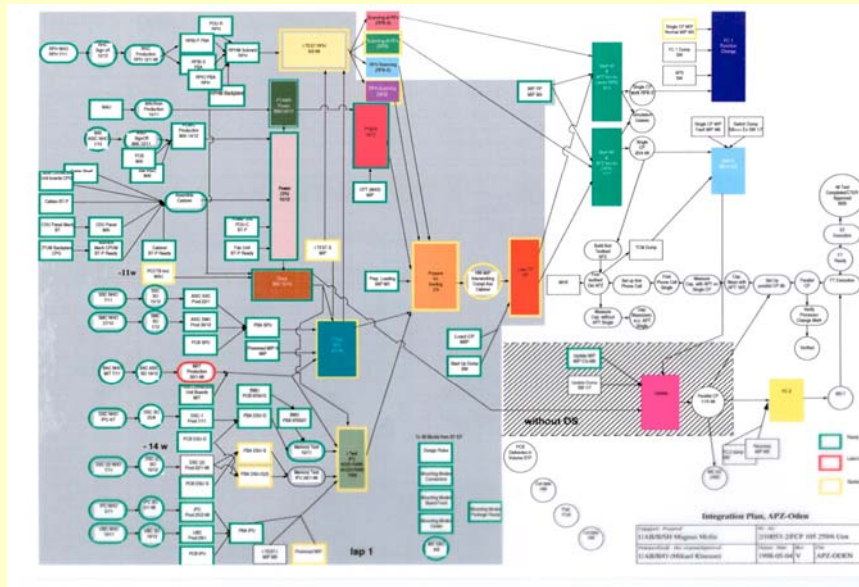
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## Increment Plan - APZ processor ODEN, Ericsson



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## Integration Plan - APZ processor ODEN, Ericsson



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## Enhanced transparency

“Before we did the integration plan we thought that RPH [sub-project] was delayed. But then we saw that *we did not need their stuff until late, in fact they were perfectly on time.* I (Interviewer): You had a different opinion about the dependencies in the project? PM: Exactly, it was the micro programming which was *wrong, totally wrong.*”

Project Manager, CPG project

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## Shared understanding is hard to achieve

*“Some kept on for two months drawing the anatomy. [...] it is still **difficult for people to agree** even if they have been sitting in the same corridor for 20 years”.*

Project manager, CPG project

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## Resistance to change

*“I’ll design this function in the end; I’ll start with the most difficult (and interesting) ones first.”*

*“It can’t be this bloody easy; I’m actually doing more difficult stuff”.*

Designers in the CPG project

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## Know thy place...

*“What we missed in the CPG project was to split the anatomy in smaller parts so that the individual designer could understand **where he participated** and where he didn't do so.”*

Project manager, CPG project

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## Summary

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## What is Integration Centric Development?

### An approach to product development

- Incremental development where the increments are chosen according to certain criteria
- Focus on proactive integration planning
- The planning is driven by the integration coordinator
- If the development is aborted - still possible to deliver to customers

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## Practical consequences for line and project

- **More persons involved earlier**
  - Integration, test and production involved earlier
- **More open dialogue with customers**
  - about the planning of the project
- **More focus on deliveries**
  - internal and external

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## Which are the risks? What does it cost?

- **Too much focus on functional requirements**
  - I.e. performance of processors and memories etc is not covered
- **More persons involved earlier**
  - as compared with other ways of working
- **Pay-back of an integration centric way of working does not always come directly**

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## What do you gain?

- Everyone's contribution is visible
- Sub goals easy to define
- Push and Pull concept - You have a receiver for every delivery
- Identifies "stinkers"
- Finds system faults early
- Visualization of project status
- Easy to identify critical paths
- Enables work in parallel in a controlled way
- Production early - if needed
- Overall System and Project view

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## Key points

- The **anatomy** provides a shared understanding of how the system works
  - Improves communication
  - Makes it easier for new personnel to understand the system
- The **increment plan** supports the distribution of work and makes re-planning easier
  - Resource- and organization
- The **integration plan** visualizes progress and responsibility
  - Makes it easier to communicate the status of the project

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## Finally

- The possibility to maneuver between the views
  - The Anatomy
  - The Increment plan
  - The Integration plan
- Control dependencies

*“The most important issue when working with complex things is to work from how things depend on each other”*

Jack Järkvik (One of the originators of the anatomy concept at Ericsson around 1990)

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## Further reading

Taxén L, Lilliesköld J (2005) Manifesting Shared Affordances in System Development – the System Anatomy, ALOIS\*2005, *The 3<sup>rd</sup> International Conference on Action in Language, Organisations and Information Systems*, 15–16 March 2005, Limerick, Ireland, pp. 28-47. Retrieved from <http://www.alois2005.ul.ie/> (April 2005).

Taxén L (2005) An Integrated Approach for the Coordination of Distributed Software Development Projects, *Information and Software Technology*, (in press).

Anderstedt, m. fl (2002) Projekt och Helhet – Att leda projekt i praktiken, För mer info <http://www.projektochhelhet.se/>

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## What we offer

- Seminars on-site
- Advice and support when working with ICD
- Introduction of ICD in your organization
- Manning of operational roles such as project management

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