SCENARIOS, STORIES, USE CASES
Through the Systems Development Life-Cycle

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SCENARIOS, STORIES, USE CASES
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A quoi ça sert?
What’s it for?

President Chirac of France,
on being shown a famous white elephant,
the Millennium Dome, Greenwich

Communicating Needs

Much of the recent history of large engineering projects—software or systems—has been a tale of waste, error, mismanagement, over-optimism, and lack of proper planning for likely costs and risks. Projects come in late, over budget, and with miserably reduced functionality. Systems sometimes never work, fail on their first period of operational stress, or are permanently unreliable and costly to maintain. We will not name names, as it is fruitless to play the blame game; indeed, engineering systems badly and passing blame are two sides of the same coin. In any case, it is all too easy to find examples in news reports of the demise of famous projects.

By the way, we do not think this is a software issue: it seems to affect complex systems of diverse kinds. The solution cannot therefore be a matter of finding better software-specific tools and techniques; it must be something that helps master complexity.

People have suggested many possible cures for this disease. Most come down to two things:

- the needs that systems are supposed to fulfil ought to be defined much earlier and far more carefully;
- people on projects ought to be made aware of and become skilled in techniques to define needs adequately.

We think that a critical element that is therefore lacking is communication and, in particular, skill in techniques for communicating needs. With the other authors of this book, we believe that the scenario is one of the most powerful techniques for discovering and communicating requirements and often the first choice for organising them.

On a lighter note, scenarios pass the party test, where the requirements engineer has to explain what he or she does for a living to a stranger in 15 seconds. Where

“I’m a systems, errm, a requirements engineer, and I help to specify complex systems...”

gets a glazed look every time; the description

“I get people to tell the stories of what their systems are meant to do, so they build the right thing”
always seems to work (and even arouse interest). Story telling is so obviously sensible that it seems surprising that it has taken so long to become a mainstream engineering activity.

**Scenarios and Requirements**

If you are wondering whether we recommend replacing requirements entirely with scenarios in all circumstances, we can at once tell you that we think that distinctly unwise, for several reasons:

- The main strength of scenarios is in telling the story of functional behaviour; it is possible to cover various non-functional aspects with stories, but it is doubtful whether such coverage could ever be comprehensive—even if that were desirable.
- Many engineers, organisations, and standards bodies are strongly attached to traditional requirement forms (like ‘The system shall ... ’), and if those forms work for those people, they should continue using them—anyway, they may have little choice if they have to comply with standards. People work better with familiar artefacts and work processes, even if these sometimes seem to outsiders to be sub-optimal.
- Making a scenario approach work well often requires flair, experimentation, and the courage to take risks, for example, running active workshops rather than writing up requirements in a back room. The implied style of engineering simply does not suit everybody.
- the needs governing large projects are complex and require a range of information structures including stakeholder and goal models, business rules, algorithms and formal specifications of behaviour, interface definitions (protocols, data structures, hardware connections), and commercial and physical constraints (like cost, size, and weight), many of which cannot be framed as scenarios.

Other vital ingredients of a successful project include

- realistic and supportive managers, including one who champions the project;
- effective training for engineers, that is, practical knowledge that changes their behaviour;
- sufficient contact with stakeholders, whether through traditional meetings and reviews, or through some form of participatory design or inquiry cycle, to ensure that the project is working from valid requirements;
- sufficient openness within teams to enable people to speak out when absurd plans are placed on the table (“test and debug a million lines of safety-critical air traffic control software in three months”).

But these are not all within our scope; scenarios don’t do everything. However, much of the book is in one way or another about helping to ensure sufficient contact with stakeholders, and the book will, we hope, help to inform engineers in a practical way about using scenarios.
Scope: A Wealth of Purposes and Techniques

In this book, we present a range of scenario techniques from light, sketchy, and agile to careful and systematic. There is no single ‘right way’ to use scenarios; we celebrate diversity in requirements discovery and modelling. There is supposedly a saying among French cooks that the English have only two sauces: brown Windsor soup (salted gravy thickened with flour) and custard (sweetened milk thickened with corn flour). Obviously, if such a thing were true, the English diet would be somewhat monotonous. Happily, there are as many ways of using scenarios as there are French sauces—for every palate, season, and occasion, and like sauces, each basic scenario technique has any number of variations.

It would have been possible while editing to impose a uniform style and ‘voice’ on all the contributed chapters, but while we have arranged for a common chapter structure and cross-references, we have chosen to encourage authors to speak in their own way. This may help readers to see that people—engineers and researchers—come to technical issues from different directions, with their own backgrounds and preconceptions, just as project stakeholders do. No one on a project has a monopoly on truth; a major strength of scenario approaches is that they allow stakeholders to share and own a description of what they want. Indeed, each step of an operational scenario may be the responsibility of a different player.

Equally, there are many kinds of scenario structures, and these may well be applicable in projects of different types. The question of which approach is best for a given type of project is open, and in the final part of this book, we sketch some preliminary answers to it.

What all the scenario techniques described here have in common is the motivation to improve industrial practice, a clearly defined approach which has been applied to projects and has a grounding in theory.

We have taken care to ensure a consistent framework for each contribution. There are no tall claims here for commercial tools; equally, there are no chapters asserting elegant but untried academic hypotheses.

Structure of This Book

The book is structured as a whole to put across the message that scenarios work and are good for your projects,

Part I provides an Overview of the nature and use of Scenarios.

Part II looks at how to apply Scenarios through the System Life cycle. It is introduced by an overview of the chapter structure used in this part of the book, and then by two chapters that review what scenarios are and how they are used. Then the chapter authors describe their techniques in their own words, but in a fixed structure, which we hope makes the different approaches easy to compare and contrast. Each chapter includes a Comparisons section to guide the reader to related chapters and to help weave the book into a unified whole. The chapters are supported not only by references to the literature but also by recommendations for further reading.
Part III presents industrial experiences of Scenarios in Action: Case Studies. It begins with an overview of the chapter structure used in this part of the book. Then the chapter authors tell their stories in their own words, but again in a structure that we hope will help you to select the experiences most relevant to your projects. Where appropriate, the text is cross-referenced to the techniques described in other chapters.

Part IV reasons and speculates a little about the future of Scenarios in The Way Ahead. Chapter 22, Putting Scenarios into Practice, reflects on the lessons learnt from the techniques and case studies in Parts II and III—the book itself serving as the basis for some very preliminary research. Part of the Way Ahead lies in the dissemination of what we already know and in the education of tomorrow’s engineers; this challenge is discussed in Chapter 23, Teaching Computer Scientists to Make Use.

The Appendices are designed to help make this a practical guide by explaining the terms used and by providing a set of scenario-based engineering templates to get you started, with simple exercises in their use—and providing answers to the exercises.
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Ian Alexander is an independent consultant specialising in requirements engineering. He is an experienced instructor and has written training courses for a range of organisations. He is the author of the Scenario Plus toolkits for the doors requirements tool. His principal research interest is in improving the requirements engineering process by modelling business goals, processes, constraints, and scenarios. He is currently exploring whether Use Cases can assist reuse of specifications for automobile control systems. He was lead author of Writing Better Requirements published by Addison-Wesley, 2002. He helps to run the BCS Requirements Engineering Specialist Group and the IEE Professional Network for Systems Engineering. He is a Chartered Engineer.

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Andrew Farncombe has a first class honours degree and spent his early career in the software industry. He subsequently moved into the defence and aerospace sector where he held a number of senior technical and management positions including that of technical director and where he led the codification of systems engineering knowledge and experience for one of the groups as a whole. At John Boardman Associates, he has applied systems engineering to the aerospace and transportation industries. Andrew is Visiting Professor of Systems Engineering at Cranfield University.
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David West is a Professor at New Mexico Highlands University (Ph.D., University of Wisconsin, 1988). He teaches systems analysis and design, introduction to business and informational systems, informational modelling and databases, website authoring and management, and enterprise information modelling and databases. He has had more than 23 refereed articles and/or invited appearances at academic and professional conferences, and multiple presentations at national and international conferences. West has worked as a consultant to more than 50 corporate clients (many of them Fortune 100 companies), as well as international clients in India.

Thomas Zink

Thomas Zink was with DaimlerChrysler research for two years helping in projects applying new requirements engineering approaches. His research focus was on use cases and stories for requirements recycling in a product family context. Thomas recently joined Nokia at the product creation site in Ulm/Germany.
Scenarios are a powerful antidote to the complexity of systems and analysis. Telling stories about systems helps ensure that people—stakeholders—share a sufficiently wide view to avoid missing vital aspects of problems. Scenarios vary from brief stories to richly structured analyses, but are almost always based on the idea of a sequence of actions carried out by intelligent agents. People are very good at reasoning from even quite terse stories, for example detecting inconsistencies, omissions, and threats with little effort. These innate human capabilities give scenarios their power. Scenarios are applicable to systems of all types, and may be used at any stage of the development life cycle for different purposes.

CONTEXT

Scenarios are simple, human things. This book reveals that there are many possible variations on the theme, and the Scope section below introduces some of the concepts; but the basic idea is just a story: someone does this, someone else does that:

The driver walks towards the car and presses his key.
The car recognises the driver, unlocks the doors, and adjusts the driving seat, steering wheel, radio, and mirrors to the driver’s preferred settings.

“Scenarios are arguably the starting point for all modelling and design” (Sutcliffe 2003). Since systems either do something that somebody wants, or are shelfware, and scenarios describe how to do things, it seems hard to disagree with the idea that scenarios are the way to begin a development—if not also to continue, as several authors in this book argue.

More and more modelling notations are being invented—I saw one in a new gadget being shown off at a trade fair, and it had no fewer than 26 symbols that somebody believed
were necessary for requirements analysis—and no end to the madness is in sight. I have no idea how the developers of such things imagine that ordinary people are going to use anything so intricate, and so far removed from life. I do have a lively idea of the blank looks I’d get from practical engineers if I tried to pull any such trick on them.

The use of the narrative scenario in engineering seems in one way to be a kind of reaction against too much technology, too fast. There is no need to be a Luddite to wonder what is being missed in the race to construct ever more complex, formal, and unfamiliar models for ever more risky projects.

Scenarios allow us to take a backward glance. They use a simple, traditional activity—storytelling—to provide a vital missing element, namely a view of the whole of a situation. And they do this at low cost, at least once people are trained in their use (Sommerville and Sawyer 1997).

The scenario perspective looks at what people do and how people use systems in their work, with concrete instead of abstract descriptions, focus on particular instances rather than generic types, being work- and not technology-driven, open-ended and fragmentary rather than complete and exhaustive, informal, rough, and colloquial instead of formal and rigorous, and with envisioned rather than specified outcomes (Carroll 1995).

Analysis means ‘dissolving [into component particles]’, which is fine and very necessary; but it also means looking at details, which as everyone knows is a way of not seeing the wood for the trees. Engineers love analysis and design: our profession’s occupational hazard is diving into detail, ignoring the people involved, and what they may want.

Using scenarios in analysis is thus paradoxical. Analysis is about refinement, precision, and completeness with respect to the parts of a problem. But scenarios are basically holistic. Whether in terse and summary form, or written out at length in a carefully studied sequence—or even in a complex analytical framework with multiple paths ingeniously fitted together—the scenario is in essence, a single thing that conveys a human meaning. And that meaning is enhanced by the reader from her own experience; the story told in the written scenario slips effortlessly into the context of the network of meaning in the reader’s mind.

“What are you doing?” sobbed the Djinni.
“I’m throwing you back into the sea”, said the Fisherman.
“Let me out of this bottle” wailed the desperate Djinni, “and I’ll make you richer than King Solomon”.
“You are a tricky Djinni”, answered the Fisherman. “You deserve the same fate as the King in the story of The King and the Doctor.”
“What story is that?” inquired the Djinni.

*The Djinni and the Fisherman*, in *The Thousand and One Nights* (850 AD onwards)

Stories are quite insistence on one point: a tale is not over until it’s finished in every detail. The Djinni is not just playing for time by exploring side issues: he’s thinking out other options and tricks that might result in a better outcome—from his dark and devious point of view. It goes without saying that the exploration is by storytelling, and the Fisherman has to use all his cunning to outwit his immensely powerful opponent. Scenario-based techniques such as searching for Exceptions, Functional Hazard Analysis, and Misuse Cases (see Chapter 7) make use of the power of storytelling to explore likely