Chapter 22
Towards Integrative Modelling of Service Systems

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Abstract The chapter is concerned with presenting an approach to the high-level and integrative modelling of service systems. The challenge of such an approach is to provide a high-level view, without overloading the representation with too many theoretical concepts, or too much detail of the final implementations of a service system. The concern is with feasible or desired configurations and the potential trade-offs implied by specific configurations; rather than an optimised specific implementation.

22.1 Introduction

Recent years have seen growing interest in services that are complex, enacted over long time-periods, and interrelate and interact with complex products (e.g., Mont 2002; Goedkoop et al. 1999). In the UK, projects such as S4T, IPAS and KIM have examined products and services in combination. Monikers such as (Industrial) Product-Service Systems (Goedkoop et al. 1999; Aurich et al. 2007) and Functional Products (Alonso-Rasgado et al. 2004) attempt to get to grips with the combined nature of product and services. Within industry monikers such as sustainment, supportability, Power-by-the-Hour and related terms such as Smarter Planet[1] indicate practitioner and corporate interest in this area.

[1] Power by the hour is copyright Rolls-Royce and Smarter Planet is copyright IBM.

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The contemporary services landscape can be seen to be rich, diverse, and fragmented (Chesbrough and Spohrer 2006; IfM and IBM 2008), owing in part to the multiple relevant academic and practitioner disciplines; rapid growth in the research into the area; and an array of existing techniques that are applicable to services (Wild et al. 2009c; IfM and IBM 2008).

Previously we have argued (Wild et al. 2009a) that the abstractions these approaches embody are not enough to demonstrate how products, services and people work together in different ways to provide value, or how we can distinguish different kinds of service systems. As part of this argument, we demonstrated that a range of common approaches did not consider all aspects that could be identified in a service system (Wild et al. 2009a).

We argue that what is missing in these approaches is an attempt to identify recurring key components across different services systems and consideration of how these components interact and relate to each other in a systemic matter. The concern of this chapter to is to present a developing approach to the integrative modelling of service systems (Wild et al. 2009a, c; Wild 2010). The approach aims to avoid viewing service delivery through a 'single' lens, for example as a technology management problem; as an information management problem or as a human resources organisational design problem. Rather, modelling service systems are viewed as a systemic activity that needs to glue or bring together different components.

The challenge of such an approach is to provide a high-level view, without overloading the representation with too many theoretical concepts, or too much detail of the final implementations of a service system. The concern is with feasible or desired configurations and the potential trade-offs implied by specific configurations; rather than an optimised specific implementation.

This chapter presents a conceptual framework for the Integrative modelling of Service Systems. The framework known as the Activity Based Framework for Services (ABFS) was first presented as an approach to relating a number of disparate and cross disciplinary definitions of service, such as Service Blueprinting, the Service-Dominant Logic and Product-Service Systems (Wild et al. 2009a). Since then it has been used to represent high-level models of service systems (Wild 2010), and it is this capability that is of concern to this chapter.

The chapter continues emphasise on thought the following sections:

- Section 22.2 provides a high-level overview of what it meant by Integrative Modelling
- Section 22.3 introduces the Activity Based Framework for Services modelling framework
- Section 22.4 covers additional elements of the ABFS approach, including: Different Types of Services and Domains; the relationship between a core and service system; The Emergent and Co-Created Nature of Value
- Section 22.5 considers various sources of complexity
- Section 22.6 reviews the chapters and relates the ABFS to the Common Integrative Framework (see Chap. 23).

22.2 Integrative Modelling

Different disciplines, technical functions and organisations can use the same terms in different ways. As a term critical to this chapter, we present a brief overview of modelling, and what we mean by Integrative Modelling.

After Collins we maintain that a model is

> a structure in one domain used to represent an object in some other domain, for the purpose of understanding or controlling it (1994).

As such, an integrative service model is a representation of a service system that aims to provide a high-level representation of the key entities within a service system, including products, service activities information, organisational roles and structures, service goals and the values by which people make effective judgements.

Curtis et al. (1992) note that models embody some kind of *abstraction* or *idealisation*. Frigg and Hartmann (2006) distinguished between Aristotelian and Galilean idealisation:

- Aristotelian idealisation strips away properties from the represented entity that are believed to be irrelevant to the problem at hand.
- Galilean idealisation involves deliberate distortions; for example, physicists build models consisting of point masses moving on frictionless planes; economists assume that agents are omniscient; biologists study isolated populations.

Both forms of idealisation can be present within modelling approaches, and are often difficult to discern. The lack of exceptions in many task and process modelling approaches could reflect a concern for high-level abstractions, or it could reflect a deliberate distortion to build normative and ideal models—for example, training purposes.

Thus, motivation for modelling has a role to play; Minsky (1965/1995) takes a pragmatic view in arguing a model of something is useful when it helps their users in resolving questions they ask themselves about the thing modelled. If the aim is to compare models across different domains then Aristotelian idealisation strips away elements that are not being compared. If the aim is to model the basics of a task for training then Galilean idealisation makes sense; rather than overloading the trainee with exceptions, the Galilean method allows simplifications for training purposes.

We can also distinguish between *first*- and *second-class* modelling concepts (Wild et al. 2009a).

- *First class* concepts are those concepts considered 'native' to the modelling approach; for example, tasks/processes and parameters in processes modelling.
- *Second class* concepts are elements which are not supported but are somehow represented through annotation and the adoption of naming conventions; for example, prefixing DOC or DB on process modelling parameters to indicate that the information comes from a document or database.

Modelling approaches of the same 'type' can embody different *perspectives* (e.g., Melão and Pidd 2000). These perspectives can be formalised into distinct theoretical positions or can exist more informally within different communities of practice. Examples of perspectives include:

- the distinction between hard and soft systems modelling (Mingers 2006; Checkland and Poulter 2006; Jackson and Keys 1984);
- different positions on process modelling such as: deterministic machines, complex dynamic systems; interacting feedback loops and socially constructed entities (Melão and Pidd 2000).

As noted, modelling approaches are defined as embodying abstractions; however, they differ in the level of detail they represent (Frigg and Hartman 2006). Compared to many modelling approaches, simulation models require a lot of detail about the domain being modelled but still make idealisations and abstractions about it. Queues and behaviours are considered a core concept in many simulations, but the size, shape and colour of the buildings are generally ignored.

In relation to abstraction, Daniels (2002) reminds us of the classic software and systems engineering distinction between *Conceptual*, *Specification* and *Implementation* models and provides simple definitions.

- Implementation model: how something is implemented (e.g., specific staff in specific roles)
- Specification model: a more abstract model that explains what should be implemented (e.g., specific roles);
- Conceptual model: describes a situation of interest in the world (e.g., broad roles needed).

The framework presented in this chapter is intended to be conceptual, which contrasts with the work of Shimomura and associates (Shimomura et al. 2006; Tomiyama 2005). Their approach, while still embodying abstractions, can be viewed as a specification model of a specific service system. Implementation models are particularly used in Software and are less applicable for representation of the complexity of an enacted service system and may simply replicate representations used in best practice in functions, such as Information Systems and Human Resources.

Terms such as Service Science and Service Systems represent an aspiration towards an interdisciplinary agenda for Services research and practice, recognising long-standing interest in Services across a range of academic disciplines and practitioner functions. Integrative/interdisciplinary research is an old term (e.g., Piaget 1970) that has had a resurgence of interest in the last few years (Winder 2005a, b; Szostak 2007; Tress et al. 2005).

We maintain that *Integrative Models* are representations providing abstractions that act to show the links between the different concepts in different modelling approaches. Integrative Models go for breadth rather than depth and will tend to be descriptive and systemic rather than predictive or prescriptive. So, while Information (data given meaning in context) and Actants (people and organisations) are first class entities within the ABFS, neither is explored with the depth of related work (see Chaps. 3, 10, 12, 20). Rather, as a *conceptual* representation of service systems the focus is on: the high-level systemic relationships between the different parts of a service system; the identification of different systems and subsystems; and recurring trade-offs between different possible service system configurations [see also Daniels (2002); Woodfield (1997)].

It remains an open question as to whether integrative models could operate as specification models. The ABFS was conceived as a conceptual model and ABFS models should be seen as a general set of concepts for understanding a research area, not tightly organised enough to be a full specification or implementation model. In its current stage of evolution, the ABFS embodies abstractions that would need additional translations for use as a specification of a Service System. Several outputs from S4T and other projects could serve as detailed specification models for a service system; for example, Enterprise Imaging (Chap. 3) and the 12 Box Model (Chap. 19).

22.3 The Activity Based Framework for Services

Three aspects re-occur across service definitions:

1. that services are *activities* (Hill 1977; Lovelock 1983; Vargo and Lusch 2004a);
2. that services activities can be *transferred* between people/economic units (Hill 1977; Lovelock 1983; Lovelock and Gummesson 2004; Vargo and Lusch 2004a);
3. that services exist in and interact with a *context or system* that includes people, tools, products, goals, values etc. (Lovelock 1983; Mont 2002; McAloone and Andreasen 2002; Wild et al. 2009a, c).

The ABFS builds on these three observations. Working from the view that services are consistently defined as *activities*—rather than objects or artefacts—the concepts of the ABFS are drawn from activity modelling approaches, such as task analysis, domain and process modelling and soft systems methodology. This synthesis produced a framework that can relate together the disparate streams of service research (Wild et al. 2009a) and help classify the design foci (i.e., what is being designed) of service design approaches (Wild et al. 2009c). The core concepts of the ABFS are represented schematically in Fig. 22.1, and discussed in turn.

22.3.1 Domain

The 'world' whose possibilities and constraints are organised in relation to specific goals. A domain is conceptualised as being composed of concrete and abstract

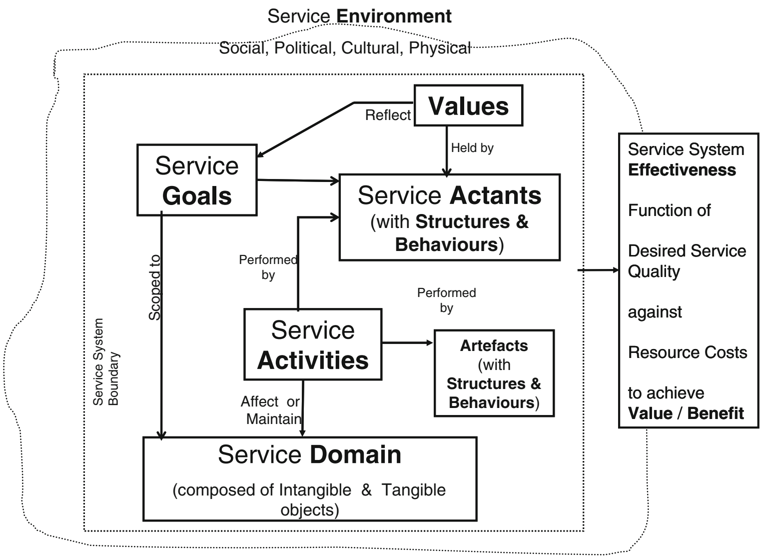

Fig. 22.1 Schematic of the activity based framework for services

objects (Dowell and Long 1998; Wild 2010). Objects are the elemental focus of services, such as heads and hairstyles or engines and aeroplanes. Objects can be abstract/intangible (i.e., informational, social) or concrete and can emerge at different levels of analysis (e.g., physical, cognitive, affective and socio-cultural). Representing domains in this manner allows for differences between different service domains and contexts to be understood and represented.

22.3.2 Goals

The specification of desired or needed changes to domain objects. They are carried out by *actants*, and sophisticated artefacts through automation, but can only be 'held' by *actants*. Classically, they are represented hierarchically, each goal mapping to a finer description of changes to a *domain* (Dowell and Long 1998; Diaper 2004). As service objects can be either concrete or abstract, goals also vary in their concreteness or abstractness. Other work suggests that goals can be heterarchical, being embedded in a complex of higher and lower level goals (Diaper 2004; Wild et al. 2004). Some activities can achieve or contradict one or more of these higher level goals simultaneously. Goals are also assumed to be public or private, as well as being cooperative (i.e., complementary) or collaborative (i.e., shared).

22.3.3 Activities

The sequence and type of actions (physical/non physical) carried out in order to achieve *goals*. Activities are concerned with changing (education, surgery, technology, upgrades) or maintaining (preventative healthcare, hardware maintenance) the states of service *domain* object attributes, when they are carried out they should achieve all, or part of a *goal*.

22.3.4 Actants

Those entities capable of carrying out activities; the term covers people, and groups of people. This element of the approach covers different teams, groups, organisation and communities as well as the overlap between them and the roles that individual and collective actants play. Key roles include service provider and service recipient, but other stakeholders are also relevant.

22.3.5 Artefacts and Technologies

The tools used to carry out activities in a *domain*. The creativity and innovation of people has enabled a huge range of technologies that enable new activities, magnify and replace human abilities and skills. People can also be in a co-evolutionary process of technological possibilities with new artefacts suggesting new activities, which suggest new artefacts (Carroll et al. 1991).

22.3.6 Values

The criteria with which judgements are made about other entities (Checkland and Poulter 2006). There is little evidence that there is a set of universally applicable values and norms for the many different stakeholders involved in activities. While the purchasing and outsourcing of services imply some kind of benefit exchange for example, saving time for cleaning services; or complementary competences for more complex services, this does not imply an automatic alignment of values. As a key component in effectiveness judgements, values affect how a system is judged by different stakeholders.

22.3.7 Environment

The world outside the service system—other than its *domain*—that has physical and socio-cultural impacts on the system, as well as being affected by it (beneficially and negatively).

22.3.8 Structures and Behaviours

Structures provide capabilities (knowledge, skills, information) in reference to a *domain*, while 'behaviours' are the activation of these structures to perform tasks. Resource can relate to be effort (conative), emotion (affective), physical (1986) and socio-cultural (Tiger 2000; Hall 1959; Elster 2007).

22.3.9 Service Effectiveness

Represented as a function of the Service Quality *goals* against the Service System setup and execution resource costs. This includes those considered as concerning the domain's reason for existence, and increasingly 'good' management also considers the wider implications for socio-cultural states, the physical environment and the affective reactions of service recipients, even in domains considered technical in nature (see Chap. 21).

22.4 Additional Elements of the ABFS Approach to Service System Modelling

22.4.1 Different Types of Service and Domains

The ABFS expands the domain concept beyond its traditional association with informational and physical changes (Rasmussen et al. 1994; Dowell and Long 1998) to take in affective and socio-cultural changes, in addition to the inclusion of structures and behaviours that can be assessed as conative, affective and socio-cognitive resource costs (Wild 2010). Because of these additional concepts, we are in a position to start representing significant differences between service system configurations. The patterns of how each element of the ABFS is instantiated start to highlight differences between different service systems.

- Theme parks use heavily engineered artefacts to induce visceral and emotional reactions, as well as physical changes to the client (e.g., gravitational shifts, exposure to water). The client's interest and ability to withstand such phenomena leads to variable experiences of the services (e.g., exhilaration vs. nausea).
- Film, music and entertainment use people and artefacts to produce and/or embody (i.e., record and play back) an abstract product (Hill 1999), such as a song, book, play or film to produce visceral, emotional social and intellectual reactions. Physical changes beyond the perceptual/physiological are not enacted.
- Recording, broadcasting and publishing services take abstract products (Hill 1999), and create either a physical media for the them (e.g., books, recordings) or transmit it via an analogue or digital signal.

- Maintenance services undertake a range of physical and informational activities to ensure a product runs, and can be supplied with consumables and replacements when needed.
- Education and training using artefacts such as books, paper, computers, simulations and other domain-relevant artefacts to change the service client's cognitive and physical knowledge and skills.
- Counselling services aim to change cognitive, effective, social and physical behaviours. The behaviours promoted are associated with a value set considered more functional than the one currently enacted by the client.

While artefacts and activities both provide an element of service (Vargo and Lusch 2004b), artefacts and activities provide it in different ways in different contexts (Stauss 2005).

22.4.2 The Emergent and Co-Created Nature of Value

Within Services Research a position has emerged that views benefit as being determined by the customer (Vargo and Lusch 2004a), and in turn entails the customer co-creating value with service suppliers. Vargo and Lusch presented a 10th Foundation Principle for the SDL that states "*value is always uniquely and phenomenological determined by the beneficiary* (Vargo and Lusch 2008)." This appeal to the often subjective and intersubjective nature of value is pre-dated by work in Economics such as that of the 'Austrian' school (see Menger 1871/1976, in Heskett 2009). In the ABFS, the values held by actants are a component in making evaluations of Service effectiveness (i.e., benefit). These in turn shape the public and private goals held by actants in the core and service system.

In the ABFS, value or benefit is modelled as an emergent property dependent on two or more parties carrying out activities, rather than an explicit entity within the Service System. In terms of the ABFS, this value or benefit is reliant on both parties having the *structures and behaviours* necessary to co-create value. Values are specifically included in the ABFS as a concept to indicate the criteria that people bring to bear on judgements of value. Often, values are traded off against each other; for example, a small premium for renewable energy versus lowest cost. Even this process is not always rational; impulse buys of clothing can circumvent values held; for example, to buy fair-trade or buying local produce. Approaches such as Spiral Dynamics (Beck and Cowan 1996; Cowan and Todorovic 2000) provide a deeper consideration of values that could act as a *specification* model of the different value sets held by actants involved in a service.[2] The ABFS includes values as a concept in order to model at a high level how values affect service effectiveness and how different value sets can be held by different partners, as well as the relationship between values and goals.

[2] Other value schemas have been identified (Hall 1959; Lages and Fernandes 2005).

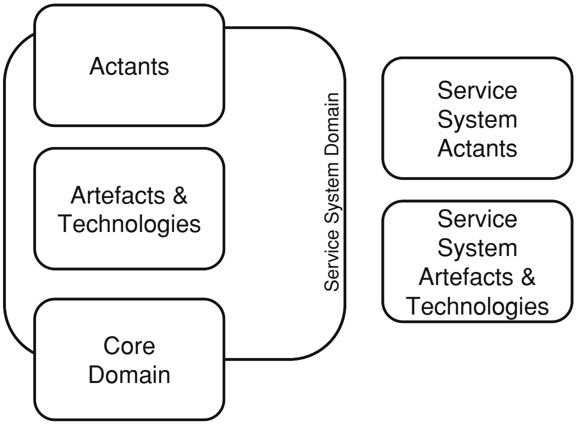

Fig. 22.2 Simplified relationship between core and service system

22.4.3 Core and Service Systems

The ABFS can be considered to outline a general high-level 'architecture' for Human Activity Systems (Checkland and Poulter 2006). Following Vargo and Lusch (2004a), we acknowledge that both products and services serve to create value for people, but in different ways and in different contexts. However, agreeing with Stauss (2005), we do not elide products and services and argue that products and services—both tangible and intangible exist within a system, and provide different and sometimes overlapping functions, depending on how the overall function is allocated to actants and artefacts (Sheridan 1988). Following on from the ABFS acting as a generic representation of an activity system, we suggest that service systems are in a fundamental relationship with a core system. A simplified view of this is illustrated in Fig. 22.2. Depending on the scope of the service design and/or contract, the domain of the service system can embrace the actants, artefacts and the informational objects of a *Core* Human Activity System. Actants would be the focus of training or education services, while maintenance services would focus on artefacts and planning support would draw upon the informational objects in the domain (e.g., fleet plans).

In this example, the goal of the core service system could be force projection (Kerr et al. 2006; Friedman 2009); the domain would be sea land and air territory, targets and the information represented about them. Artefacts could include a range of options, such as the carrier strike fleet, comprising an aircraft carrier and its air fleet, destroyer submarine support and supply vessels, as well as long distance reconnaissance artefacts (e.g., satellite, AWACS). Core system activities embrace tasks such as target identification, tracking and elimination, command and control or evacuation of personnel, and are enacted through and enabled through the artefacts of the carrier group.

Table 22.1 provides an illustrative example of an ABFS model in relation to the ATTAC and ROCET availability programmes. This is meant to be illustrative of

Table 22.1 Elements of the ABFS in relation to ATTAC and ROCET

ABFS	ROCET and ATTAC
Domain	CORE SYSTEM: Airspace, targets SERVICE SYSTEM: Physical objects such as aircraft and their major subsystems (e.g., engine, airframe, weaponry, avionics and ejector seat) COMMON TO BOTH Abstract objects such as usage patterns (e.g., Peacetime, Storage, Theatre, Fleets within Fleets). RAF staff (training, emotion and articulation work)
Goals	CORE SYSTEM: The overall goals of the RAF broken down to map to specific fastjet instantiation (e.g., reconnaissance, bombing, interception and training) SERVICE SYSTEM: The overall goals of the ATTAC/ROCET service system, both formally defined and contracted (i.e., KPIs) monitored (PIs), and less formally through ongoing discussion, collaboration and evolution
Activities	CORE SYSTEM: Maintaining the security of UK and UK-controlled/ protected airspace; reconnaissance; projecting munitions at targets SERVICE SYSTEM: Concrete and abstract activities. The former being heavily concerned with physical maintenance of the platform and the movement and storage of components and modules. The later concern flight and fleet planning, lifecycle costing, reporting and information/ knowledge management
Actants	CORE SYSTEM: Relevant RAF pilot, co-pilot. Ground crew, 1st line SERVICE SYSTEM: RAF (IPT, flight and ground crew); BAE Systems (Project (ATTAC) and Capabilities (e.g., Engineering for Support); and Rolls-Royce Project (ROCET) and Capabilities (e.g., Various service lines)
Artefacts	CORE SYSTEM: Aircraft and their major sub-systems (e.g., engine, airframe, weaponry, avionics and ejector seat), runways, weapons, fuel SERVICE SYSTEM: Ground Support Equipment, Hangers, Bays, HUMS, Specific LCC costing software. General computers and software, general artefacts, forms engine logs etc
Service effectiveness	CORE SYSTEM: % target id, % target eliminated, % successful take off and landing, availability of assets SERVICE SYSTEM: The costs of maintaining the structures and behaviours for the Tornado platform. Can be costed in financial terms, but broader issues are present, such as changes in levels of trust and openness to service innovation or taking on more non-traditional service areas.
Values	CORE and SERVICE SYSTEM: ATTAC and ROCET are driven by contracted and high-level goals (e.g., Defence Industrial Strategy). The latter are concerned with the values held by each organisation involved in the contracts, but also with the value placed upon retaining UK military and general engineering capability. Values associated with value-for-money; availability in generally; dependence/independence; interdependence; duty-of-care;
Environment	CORE and SERVICE SYSTEM: Socio-cultural: Covers the culture within the MOD, RAF, RAF-IPT and industrial partners. Attitudes to risk, the rate and reasons for changes to culture. The political attitudes to armed services; costs of armed services; risk of conflict.

the broad relationship between the framework and a domain and is not a definitive account or report of case studies of ATTAC or ROCET [see Chaps. 2–5, and (Wild 2008)].

22.4.4 Changes to Service Systems

The economist Hill was keen to stress the role of exchange in defining services, and to distinguish between activities that can and cannot be solely performed by oneself. He noted that

> if an individual grows his own vegetables or repairs his own car, he is engaged in the production of goods and services. On the other hand, if he runs a mile to keep fit, he is not engaged because he can neither buy nor sell the fitness he acquires, nor pay someone else to keep fit for him (1977)

This indicates that there are transferable activities, and that this exchange is subject to constraints, such as physical laws and socio-cultural practices. The former include Hill's exercise example along with other biological based-processes.

These activities could be modelled using the concept of Enabling activities (Whitefield et al. 1993). Enabling activities are activities that place or maintain artefacts and people, in a particular state for normal or enhanced use (e.g., exercise, food growing and preparation). For complex services, physical constraints still operate (e.g., the size and location of air or naval bases) but they are less inherently resistant to transfer than biological functions. Decisions to outsource services should centre on the nature of the outsourcing organisation's core mission and the resources needed to enact that mission. The general process of service outsourcing assumes that the external partner has structures and behaviours that enable it to provide complementary or enhanced service quality and/or lower cost. This can be due to economies of scale, reduced facilities replication costs, additional capabilities such as greater numbers of personnel and assets to deal with surges, higher levels of product knowledge or better capability to model asset usage (McIvor 2005; Mol 2006). It is also assumed that this is done in a manner that reduces factors such as trust security, or the ability of the core organisation to maintain its core mission in the face of changes.

The end of the Cold War and recent economic events have placed restrictions on military and non-military economic resources. Several key projects have been enacted to find ways of both reducing normal operating budgets and to increase asset availability. Terry et al. (2007) discuss the contracts for the support of the UK's fleet of Panavia Tornados, which is now undertaken through collaboration with industrially-based partners (BAE Systems, Rolls-Royce and additional supply chain organisations). The core activity of system's domain concerns transformations such as maintaining the security of the UK and UK-controlled airspace, engaging in reconnaissance, and, where necessary, projecting munitions at targets.

Thus, the domain embraces airspace, threats and allies, both as actual physical objects and higher-level information about them. In executing tasks in this domain, additional abstract objects are created to represent pilots, fleets and operations. One artefact to enact this mission is the Panavia Tornado fast jet. As highly complex engineered artefacts, Tornados require substantial maintenance support and upgrade, alongside routine activities such as refuelling. In recent years, large amounts of these activities have been taken on by industrial partners. RAF maintenance staff retain responsibility for day-to-day physical changes, but with the support from industrial staff in roles such as programme, supply chain and fleet management. There is a move to shared planning activities so that the same information is not generated two or three times for different parties (e.g., RAF, BAE Systems and Rolls-Royce) and so that maintenance plans do not clash for different service systems. This information is vital to the maintenance planning and execution, as are the RAF base staff and facilities used within the service system.

Using Whitefield's (1993) terminology, the RAF's previous arrangements utilised a series of enabling entities (activities, actants, artefacts) within the 'original' RAF core system (see Fig. 22.3). In contrast, the post ROCET/ATTAC has greater resemblance to Fig. 22.4, with the service sub-system becoming a service system in its own right.

Effectiveness measures such as cost and availability have changed in the new arrangement, with the former going down and the latter increasing. In contrast, some resources such as trained maintenance staff have decreased.

What is not represented in Figs. 22.3 and 22.4 are the values held by actants within different systems. Before ROCET and ATTAC, we assume that the boundaries between the core and support system were softer; the 'manager' in

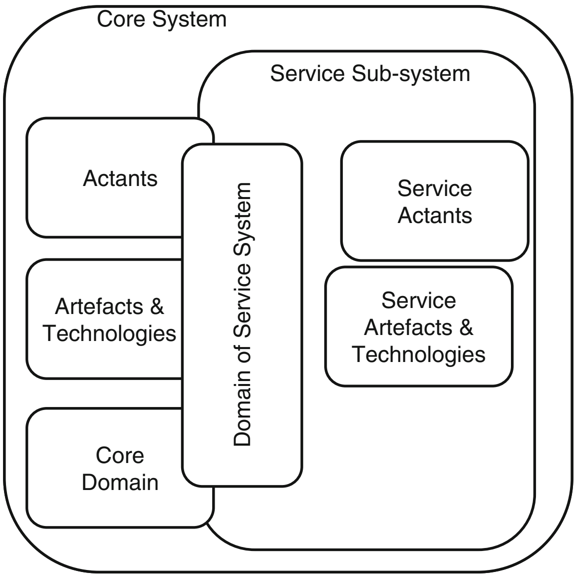

Fig. 22.3 Pre ROCET and ATTAC, maintenance is a sub-system of the core system

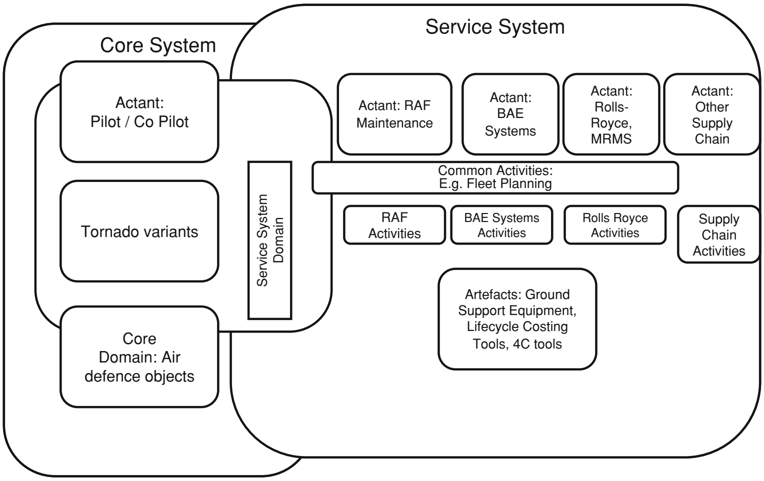

Fig. 22.4 Post ROCET and ATTAC, maintenance is a separate service system

charge of the core system was responsible for the service system. Both groups were recruited, trained and employed by the same organisation and could be assumed to work with a value set and organisational culture more closely aligned. Post-ROCET and ATTAC, we can assume that boundaries are more firmly set, formally through the contract and more informally through the different tools used, varying organisational identities, the buildings worked from and the lines of management they report to.

However, it is not always as clear-cut as 'them and us.' As staff are transferred from the MoD to industry and there is greater interaction between the different service recipients and providers, there is also the potential for the development of greater understanding between partners through articulation and emotional work (Hochschild 1979; Schmidt and Bannon 1992). While such concerns may never become formalised in contracts, they become an explicit part of ongoing relationship management activities, both explicit and implicit. In turn, the relationship is not one way; in ROCET, the programme manager was keen to impress the need to embed with the RAF, culturally and physically to better understand their service requirements and learn about their culture and practices (Wild 2008).

Because service systems are socio-technical and include people, such changes cannot be modelled deterministically. Transferred staff, however well they are treated in the transfer, can still end up lacking motivation due to a conflict in the their values of the organisation they end up in. In contrast, they could also learn to embrace the view that there is nothing inherent with pursuing reasonable profit and revenue and that it can be an effective way for maintaining military capability in financially restricted times. After all, it was these same profit making companies that provided the artefacts that support the core mission.

22.5 Other Modelling Issues

Within this section we consider how issues such as complexity, adaptivity and the emergent nature of value relate to the concepts of the ABFS.

22.5.1 Complexity due to differing and conflicting values

Values affect how actants view the effectiveness of service system configurations that are acceptable and unacceptable (e.g., labour and timesaving vs. social cohesion). For example, placing high value on one's carbon footprint can lead to transport choices such as cycling and walking, which may be in a trade-off situation with time use goals and values. Alternatively, certain values and their trade-offs may lead to alternative behaviours such as carbon offsetting, using renewable fuel and lift/car share schemes.

Values are a key aspect of scoping the other elements of a service system. The form of the service system can reflect the values held by its actants. While a high-level goal of restaurants is to provide food and generate profit, the values held by the owners, staff and patrons could drive radically different manifestations of eating location, menu and experience. Comparing a high-class restaurant with a roadside catering outlet without reference to values would be meaningless, yet their basic transformations and domain objects remain remarkably similar: the preparation and serving of foodstuffs.

Some individuals and groups see their values as true and objective; those who do not share your values are classed as having none (Beck and Cowan 1996; Goodwin and Darley 2008). With respect to services, one key trend in recent years has been the emergence of availability and capability contracts (Terry et al. 2007; Tukker 2004). These go beyond outsourcing to contractual arrangements where two or more partners work together to deliver services. In many contexts, this brings commercial and non-commercial organisations together with a potential for clashes of values, the most obvious being when public sector services interact with commercially oriented organisations. Furthermore, these arrangements rely on the service recipient providing facilities back to its supplier, with both parties acting as supplier and recipient of services.

In other contexts, service design is tackling the design of public services, another situation that can bring together different actants and values, from the efficiency driven targets beloved by bureaucrats and politicians to those concerned with retaining or promoting broad and difficult and abstract goals, such as community cohesion and community participation (Seddon 2008; Parker and Heapy 2006). Values can entail complexity because values are often difficult to articulate and can result in implicit or tacit behaviours being performed that actually go against stated or believed values.

22.5.2 Complexity due to multiple and overlapping actants

One reason for complexity in service systems is the need for multiple organisations (in ABFS terms, collective actants) to work together. Given the size and scope of many service contracts, this can also entail organisations which are competing in other markets to work together. While process alignment and complementary competencies are seen as key parts of service co-creation (Chap. 6), this tension between organisations adds to the complexity of assessing service system success. While public goals can be developed and discussed, most actants will retain private goals that will affect how they carry out service activities and ultimately affect how they will judge the success of a service system.

22.5.3 Complexity due to multiple, overlapping and private goals

Service providers' motivations in providing complex services are varied. Sometimes they complement national policies (MOD 1998) while at other times they are concerned with keeping competitors at bay. The contract bidding goals are often driven by cost-reduction concerns rather than longer-term considerations, such as maintaining front line capability in the core organisation through readily available staff. The ABFS offers the potential for representing this complexity by being able to distinguish between goals of the core domain and service domain; higher-level goals concerning the required resource costs for setting up and maintaining as service system; and the possibility that goals remain private, but still affect behaviour. Through the acknowledgement of public and private, shared and non shared goals (Wild 2010), we have a mechanism for articulating, representing and discussing some of the complexities multiple and overlapping goals.

22.5.4 Complexity due to multiple roles for a service system

The relationships between service systems can be complex. One source of complexity is where the core system provides 'services' or assets usage back to the support system. In contracts such as ROCET and ATTAC, this is referred to as GFX or 'government furnished assets' (see Chap. 13), and within these contracts the industrial partner makes use of government assets in order to provide the service, with these assets embracing office space, maintenance workspace, tools and personnel.

In some cases, such as military ones, service contracts reflect the need to maintain the ability to service equipment in-theatre, as well as reflecting regulations on non-military personnel working in-theatre. In other contexts, a services customer may wish to retain some aspect of support in-house (McIvor 2005; Mol

2006). A core system providing services back to the service system is not restricted to the provision of physical assets. Activities such as providing asset usage information and plans can be viewed as services back to the service provider, as well as a key facet of co-creation.

The core system can also be considered a service system itself. Defence services are set up to provide services to its native populace and government or the populace and government of a defended territory. There can be a repeated and complex pattern of relationships between different core and service systems. Human activity systems are in numerous co-creational relationships.

22.5.5 Complexities of Service Aims

The ABFS represents the distinction between when a change is the 'goal of the system' and when it is a 'resource cost.' Whether or not wider forms of resource cost are explicitly taken into account in the Service Design process, all service systems have such resource costs. They are ecological, socio-cultural, emotional, as well as our usual measures of 'cost' such as time, throughput and financial costs. The ABFS allow us to distinguish between situations where, for example,

- Affective issues are an evaluative criterion alongside others (e.g., work applications)
- Where affective states such as 'fun' are the goal of the activity (games and theme parks)
- Where affective states such as 'fun' are balanced against other factors such as 'knowledge gained' (e.g., modern interactive museums)

Thus, the same factor can act in different ways in different service contexts. In the S4T context, while the maintenance or change of affective and socio-cultural behaviours is unlikely to be a core part of the contracted process, both remain important (see Chaps. 2, 5, 6, 9). It is naive to assume that services, which in general require greater interaction than a product development process (Parker and Heapy 2006, Chapter 20; Bitner et al. 1997), do not require emotional (Hochschild 1979) and articulation work (Schmidt and Bannon 1992) to maintain the ongoing relationship.

22.6 Conclusions

The Activity Based Framework for Services' development can be characterised in three movements.

1. To situate and relate different disciplinary definitions of services (Wild et al. 2009a).

2. To understand the difference between the design foci of different service design approaches (Wild et al. 2009c)
3. To produce models of service systems (Wild 2010).

This last issue has been the concern in this chapter and we have presented a high-level approach to the modelling of service systems. In modelling mode, the ABFS produces high-level models of service systems and can be seen to 'sit' on top of a number of modelling approaches, both generic and developed specifically within the S4T programme (e.g., Chaps. 3, 10, 12, 20). We have suggested a foundational relationship between a Core system and one or more Service systems, and presented examples of how concepts within the ABFS represent issues of transformation and complexity.

Given that this volume has already presented a framework that makes claim to provide an Integrative perspective for Complex Services, the Common Integrative Framework (see Chap. 23), we consider how the ABFS relates to the CIF.

As the nascent discipline of Service Science/Systems matures, we can hope that more and more approaches will emerge that are a synthesis of approaches from the many fields (IfM and IBM 2008) that can contribute knowledge to services. A less ambitious vision is to show systematically the links and relationships between the concepts and strands of research (Kagan 2009). Such synthesis can be furthered by work that explores the connections between knowledge communities and abstractions common to different disciplinary knowledge bases (Wild et al. 2009a, c).

As a field of study emerges, the level or strength of integration can vary. Many frameworks and approaches to Services can be found (Wild et al. 2009a; Sampson and Froehle 2006; Vargo and Lusch 2004a; Lovelock and Gummesson 2004; Hill 1999). These are in addition to 'locally' developed approaches within organisations and companies providing services and service design capabilities (Vanguard Consulting 2005; Seddon 2008; Parker and Heapy 2006; Guardian 2010; Cabinet Office 2010). Many of these approaches make the claim that they are generic to *all* services (Sampson and Froehle 2006; Vargo and Lusch 2004a; Lovelock and Gummesson 2004), in effect claiming to be integrative.

Elsewhere (Wild et al. 2009a) we have argued that frameworks are a general set of concepts for understanding a research area; that they are not tightly organised enough to be a predictive theory and that they sketch out the general concepts of a field of enquiry and the possible relationships between them. In turn we have noted that frameworks could occur at one or more of three different levels (Wild et al. 2009b), see also (Rao 2007).

- The Strategic level is normative and is concerned with action and sequencing commitments and issues such as what should a project recommend to partners as well as making sense of the broad contributions to Services Science a project can make.
- The Tactical level is descriptive. It is concerned with abstractions applicable to all Service Systems; that is, how do we model recurring elements of a service system?

- The Operational is the methodological level. It is concerned with the actions that realise strategy, and maps how research project outputs relate to specific methods.

Overall, we consider the CIF to sit predominantly at the Strategic level while the ABFS sits at the Tactical level. The CIF is a high-level, normative and strategically oriented framework that discusses high-level relationships between Information, Material and People, in the co-creation of value, and the broad transformations an Engineering Product organisation would have to undergo to provide services to complex products. In contrast, the ABFS, while relatively high level, is descriptive in nature.

This relationship between a core and one or more service systems also relates to the relationship between the ABFS and the Common Integrative Framework (CIF), which is illustrated in the next figure. Here, we demonstrate the mapping between the three transformations of the CIF and the concepts of the ABFS (Fig. 22.5).

In contrast to the CIF, the ABFS goes beyond stating that service systems transform material, information and people, to provide more detail about what is being transformed. For example, is the service system transforming people's physical structure and behaviours (sports/exercise coaching); minds (education, counselling, and entertainment); a combination (e.g., theme park); their physical assets (e.g., decorating, car or other equipment servicing)? In turn, what artefacts are we using, what activities are undertaken by the service system and by the core system? The ABFS, by offering a set of concepts common to all service systems, can start to tease out the complexities of the service system design and the distinction between different 'kinds' of service activities within the same contract or service system.

However, Service Science is still evolving and the challenges of developing designing and engineering services around complex engineered products entail many different tools and perspectives. We have argued elsewhere that frameworks can exist at different levels for different purposes, and that they can relate and

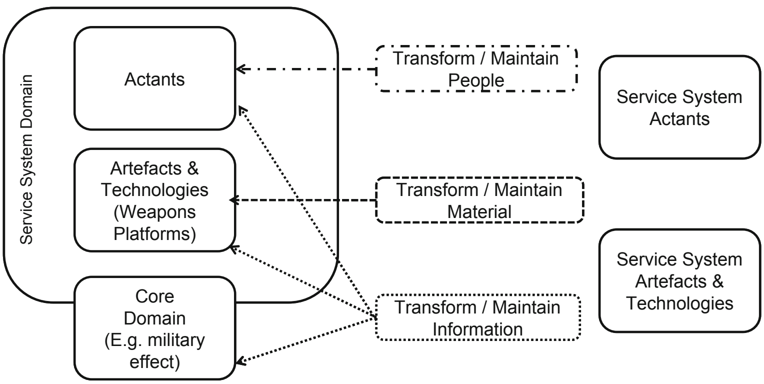

Fig. 22.5 Outline of the relationships between core concepts of the ABFS and the CIF

complement each other (Wild et al. 2009b). We expect both the CIF and the ABFS to continue to evolve, to interact, but to retain a focus at different levels of concern.

22.7 Chapter Summary Questions

We conclude with a number of questions about modelling approaches in general and in relation to Service Systems.

- What decisions about the types and scope of the abstractions are made in modelling approaches?
- What explicit and implicit links between modelling approaches can be identified and can they be pushed upwards into lightweight integrative models?
- Are modelling approaches aiming to model concepts, specifications, implementations or some combination of all three?

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