Open Analytics

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Abstract:
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HP Open Analytics provide all of the stakeholders in managed service analysis, design and management with mathematically based models, analytic tools and processes that enable repeatable, shareable and auditable analysis of business objectives and systems design based upon meaningful performance, availability and agility requirements. During the design phase of a system, they enable the impact of design decisions on a 'virtual' business to be explored. Over the lifetime of the managed service, they enable the impact of changing requirements and business evolution, as well as new technologies to be mo nitored and assessed - at one level on the business objectives and at the other, on the supporting service and information system infrastructure.

The service is being extensively tested within the EMEA region with financial, government and industrial partners. The research and development methodology has relied on a close partnership between HP Services, HP Laboratories and the customers with whom the tools and workshop processes have been trialled. This report describes the role of Open Analytics and the HP Service Explorer framework that unifies tools and processes.

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Abstract

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Analytic Models

The primary purpose of a model is to enable an organisation to make predictions. The model can then be altered to examine the consequences of alternate structures and assumptions on those predictions, allowing the organisation to make rational decisions based upon likely scenarios. Our research demonstrates that organisations that make effective use of models typically see benefits in a number of different areas

- the act of creating a model forces an organisation to consider and review the structure of the business, investment or product that they are proposing to create; such a model, even if it is never deployed in anger or formally analysed will often play an important role in the initial feasibility study (for instance early computer based modellers found that the model rarely need to be run, the act of creation informed them as to where system problems would lie);
- a model can act as important documentation of a system, the evolution of such a model, if documented, is an invaluable aid in the audit of a project;
- a model can act as a valuable communications aid, allowing discussions to be grounded in a common representation ;
- models allow for rapid exploration of the decision space that an organisation is operating in, enabling multiple scenarios to be played out at low risk;
- models may be used to qualify and then check real systems; as the system runs, the behaviour of the model is compared with observations of the real system and discrepancies are investigated;
- models can demonstrate the sensitivity of a system to environmental changes, enabling users to design out (as much as is possible) potentially disruptive non linearities in the system behaviour;
- models can be used to check the correctness of particular approaches to problem solving;
- models permit the early capture of error, as they permit non-existent systems to be studied, with the well known benefit of capture time against value saved.

Four interacting classes of models are constructed;

1. user and usage models: these capture the ways in which groups of users interact with the information systems, in terms of application and services, as well as over time (of day, month and year);
2. architectural models for performance: enable the performance of a system to be predicted before it is constructed in the context of predicted usage and user experience;
3. architectural models for reliability: allow proposed systems to be tested for reliability, and where necessary, the impact of strategies for system hardening (warm standby, multiple redundancy etc.) to be determined;

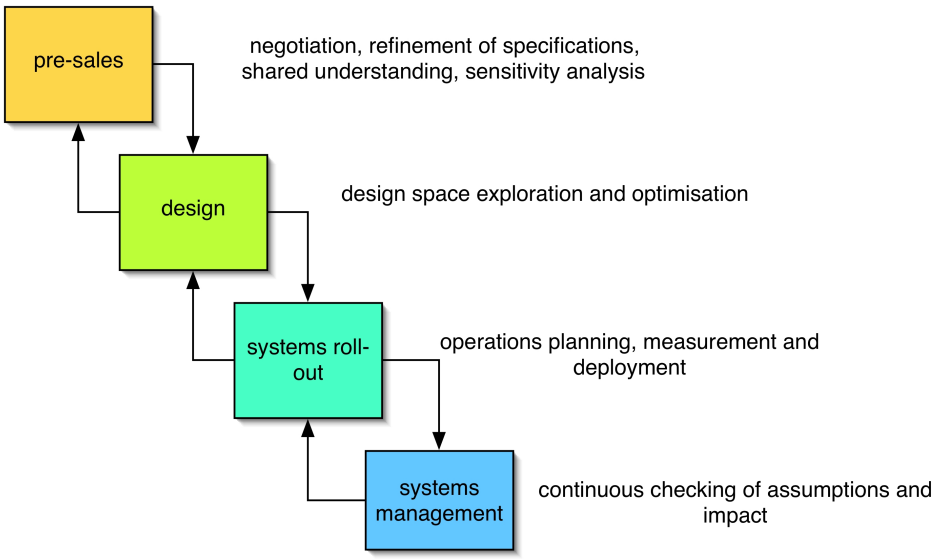

Figure 1: A high level view of the system life-cycle and the application of Open Analytics at each stage

4. service and servicing models: enable the impact of service models (engineer placement, spares stocking and location, mean times to repair etc) on system cost, availability and usability to be predicted.

These models are composed so as to enable systems designers to take a structured approach to design space exploration, determining the impact of trading user experience against cost and reliability, or peak performance against cost. Importantly, the models allow designers to operate a process known as 'technical scenario planning', exploring the stability of proposed solutions to user and technology shifts. The intention of this process is not to develop highly optimised solutions, experience demonstrates that such systems are highly sensitive to small changes in initial assumptions (document size, availability or daily usage patterns for example), but to develop solutions that are stable to change in both initial assumptions and have clear expansion paths both functionally (additional services and applications) and in terms of performance and robustness.

Application through the service lifecycle

Models are not constructed as one-offs during the design phase instead they have roles at each stage in the life-cycle of a service (Figure 1)

- pre-sales: basic models systems are constructed to ensure that HP has a clear understanding of the implications of proposed systems specifications and service level objectives, and that they can be met at an appropriate cost;
- design: the models developed during the pre-sales negotiation are refined as additional information regarding system utilisation and requirements, as well as component and service

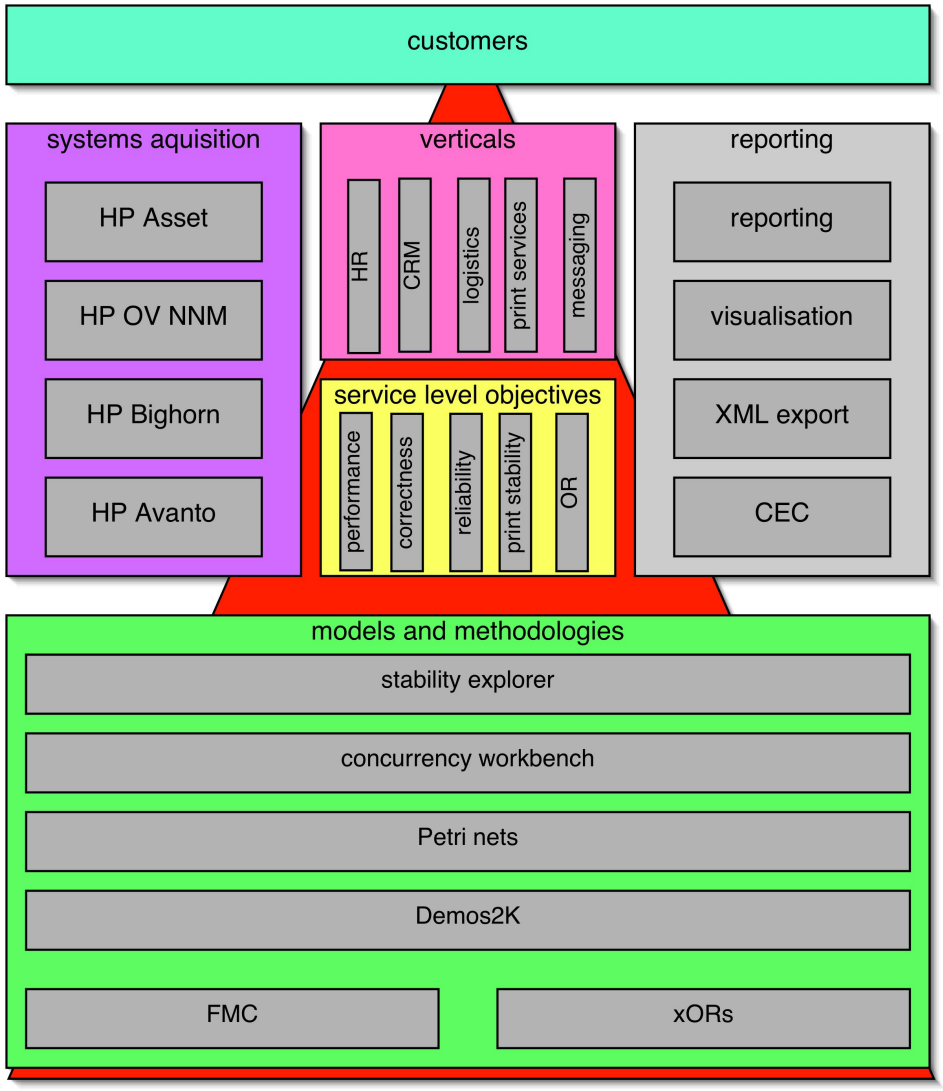

Figure 2: The Open Analytics Service Explorer framework

innovations, become available; at this point design space exploration and optimisation against cost, performance, reliability and scalability is carried out;

- as accurate models are available well in advance of the deployed systems, deployment and service processes, as well as measurement and management infrastructure can be tested on a virtual system, reducing deployment risk;
- models are maintained throughout the lifetime of the system, and their predictions continuously checked against observation. Divergence between prediction and observation is used to both correct the models as well as track environmental and systems changes.

The technology

HP makes use of the Service Explorer framework (Figure 2) to model and maintain systems. This makes use of five distinct components

systems acquisition enables the gathering of live data for the purpose of either building initial systems models or analysing extant systems; currently this is based around four key data sources

- HP Asset : enables systems exploration and data harvesting from previously ad-hoc collections of compute, print and communication assets;
- HP OpenView: enables the gathering of live data on systems behaviour (communications, storage, compute and security);
- HP Bighorn: monitors and manages hard copy assets;
- HP Avanto: maintains performance, reliability and availability data on both HP and 3rd party components (hardware and software)

models and methodologies the mathematical basis for the systems analysis and comparison

- xORS: operations reference models which document and enumerate best systems practice and the impact of such practice on economic factors;
- FMC: federated model collections which enable models of different types (such as user, architecture and services) to be combined and co-analysed (allowing for example, the impact of topology to be estimated concurrently with service cost and component selection);
- Demos2K: a formally validated, simulation oriented description of systems, which can be compiled or automatically re-written into multiple representations dependent upon the questions that must be asked of the model (correctness, performance, availability, agility etc.);
- Petri nets: a representation mechanism that enables performance metrics to be assessed (primarily throughput and response times);
- Concurrency workbench: a system for analysing the impact and behaviour of concurrent (parallel) systems within a compute and communicate environment);
- Stability explorer: an automated design space exploration system that can be tasked to search for solutions that meet specific criteria (service, architecture, topology, component and cost);
- Rapid Scenario Planning (RaSP): enables all stakeholders in a project to co-explore the impact of specifications and requirements on systems structure, agility and cost;

presentation mechanisms for enabling the output of these modelling tools and techniques to be distributed to domain, as opposed to systems experts

- reporting: a scriptable system that enables a combination of model and systems reporting to be customized on a per-application basis;
- visualisation: visual systems description mechanisms that enable multiple solutions to be compared and contrasted quickly based upon specific user criteria and objective functions;

- XML export: enables the transfer of the results from modelling, observation or some combination of the two to be exported in a form that other vendor specific tools can absorb and analyse (for both analysis and audit purposes);
- CEC (customer experience compiler): enables the transfer of models and observables to enable the end customer to experiment with and observe the impact of their own behaviour on systems parameters (service, architecture, topology, component and cost);

Between them, the models and methodologies enable specific service level objectives to be defined and appropriate (to the organisation) service level agreements to be formed in the areas of

- performance: response time and throughput;
- correctness: the demonstration that (especially) custom protocols for synchronization and disaster recovery will meet their specification;
- availability: a combination of topology, component selection and service selection to meet systems requirements;
- stability: the demonstration that prospective solutions are not simply optimal based upon initial systems specifications, but will also track both errors in original assumptions/specifications as well as evolutionary changes in business and systems processes;
- operations: the design and management of systems roll-out, so as to optimise for specific characteristics (stability, cost, risk)

These are combined (on a per customer segment basis) to enable solutions for specific verticals (for example, finance, pharmaceuticals, manufacturing etc).

Engagement based proof of concept

The tools and processes developed and deployed as part of the Open Analytics research programme have been applied to a wide range of HP technology products and services. For the purposes of this document, we are concentrating on services; significant recent engagements in collaboration with HP Services include

1. LCH.Clearnet (financial managed services);
2. UK Ministry of Defence Information Infrastructure Futures (originally as a member of the Lockheed-Martin consortium and more recently as a capability partner of the EDS Atlas consortium);
3. US Defence Logistics Agency (analysis of novel bidding mechanisms and their impact on infrastructure and return);
4. US Government Agency (co-analysis of design and management of future supercomputer architectures and associated services);

5. Alcatel (optimisation of distributed print management systems across European offices);
6. UK National Health Service (analysis of extant infrastructure and the role of service level agreements);
7. UK Department of Work and Pensions (infrastructure design, management processes, service level agreement analysis);
8. UK Foreign and Commonwealth Office (infrastructure design and service management); In most cases these engagements have been at a pre-sales stage, identifying and modelling critical risks, assessing and negotiating service level objectives and their corresponding agreements, and finally sizing and specifying infrastructure appropriate to the customer requirements.

A closer look at the impact

One example of the impact that this ability to more accurately discuss and then provision information systems can be seen in the context of a bid with the UK Ministry of Defence.

1. The original Defence Information Infrastructure bid (DIIF) was worth in excess of $4B to HP over a 10 year period. Assessment of the money at risk made by Lockheed-Martin and based upon inadequate analysis of the systems and their requirements assessed the overall at risk money at $400M. Subsequent analysis by HP demonstrated this to be much closer to $100M, clearly changing both the cost and the likely dynamics of the project. The HPL Open Analytics team continued to work with both HPS and the customer to demonstrate why the solutions being proposed would meet their requirements and to refine the Service Level Agreements (SLAs) that were being proposed. This resulted in both the relaxation of some SLAs, with consequent improvements in real value for money related to actual business need, as opposed to perceived need, and the tightening up of others, again intended to meet real vs. perceived requirements. This bid was abandoned because Lockheed-Martin withdrew from the consortium and contractually, despite the best efforts of the UK Managing Director, HP was unable to assume leadership.
2. HPs involvement did not however end here. The MoD were impressed by the analytic approach that HP was taking to the analysis and design of their infrastructure, and they are now requiring that analytic justifications for sizing and service structure be put into place for the final round of bidding. The Atlas consortium have been told that their bid is inadequate in terms of infrastructure design, EDRMS, security and service desk and told that they should work with HP to analyse, model and optimise their bid. In return for providing analytic capabilities, HP will become a capability partner in the consortium, providing both infrastructure and a long term systems modelling and assessment service.

In the first instance, these technologies and their application with HPS were being deployed as order winning criteria. Risk assessment and reduction through systems and infrastructure design enabled HP to be confident that what we were signing up for was both practical and within acceptable limits of commercial uncertainty.

In the second instance, the customer has determined that these technologies are required for them to have confidence in the service and systems provider. They have shifted from being winning criteria to order qualifying criteria.

Conclusions

Service customers will need to demand more insight into solutions being offered to them, and service providers more understanding of the nature and dynamics of the business objectives that are being supported by those services if outsourcing of critical systems is to be successful. HP Open Analytics provides a means of supporting just that - shared analytic models, sophisticated, robust and reliable design space exploration mechanisms, and a means of determining and directing resource utilisation over the lifetime of a project.