Performance Assessment for e-Government Services
An Experience Report

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Australian Government
Department of Communications, Information Technology and the Arts
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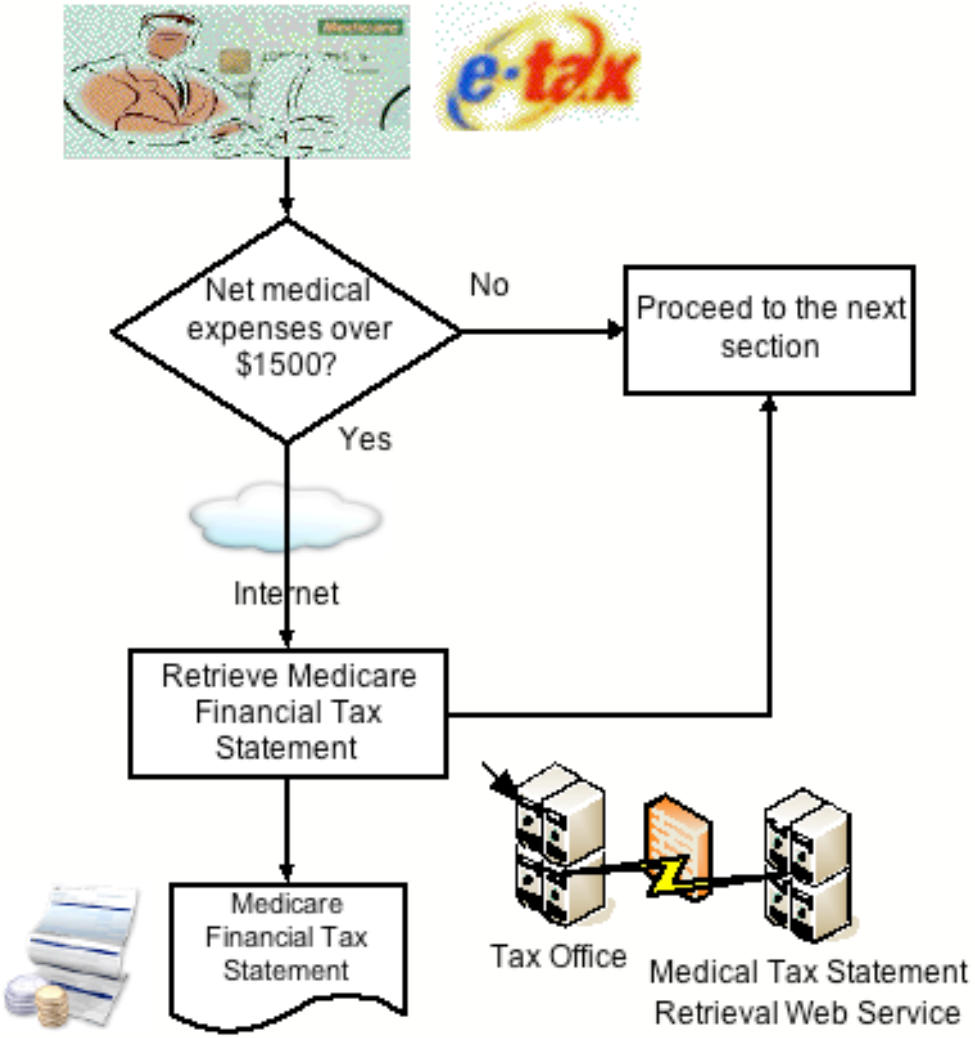
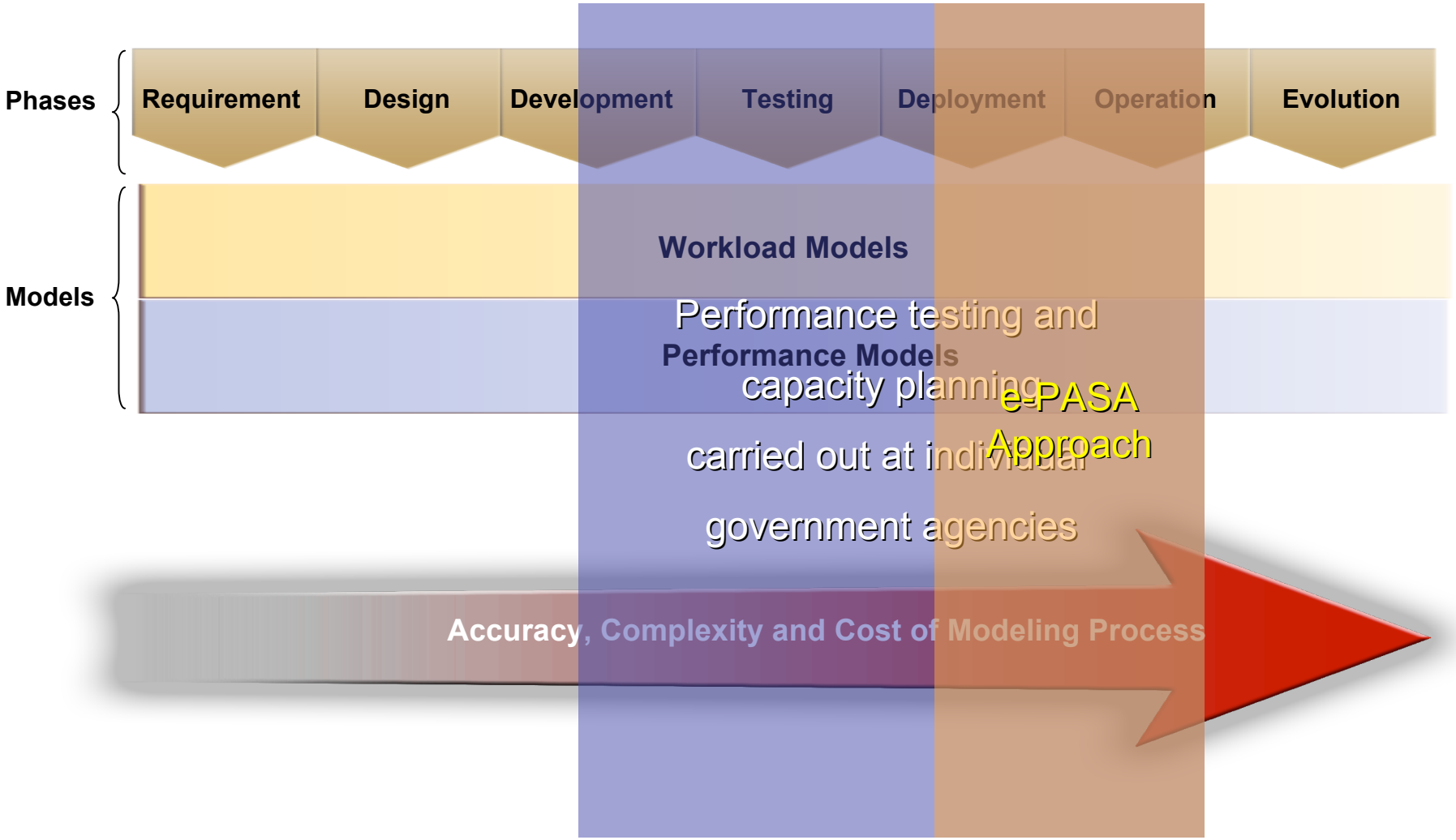
Scenario

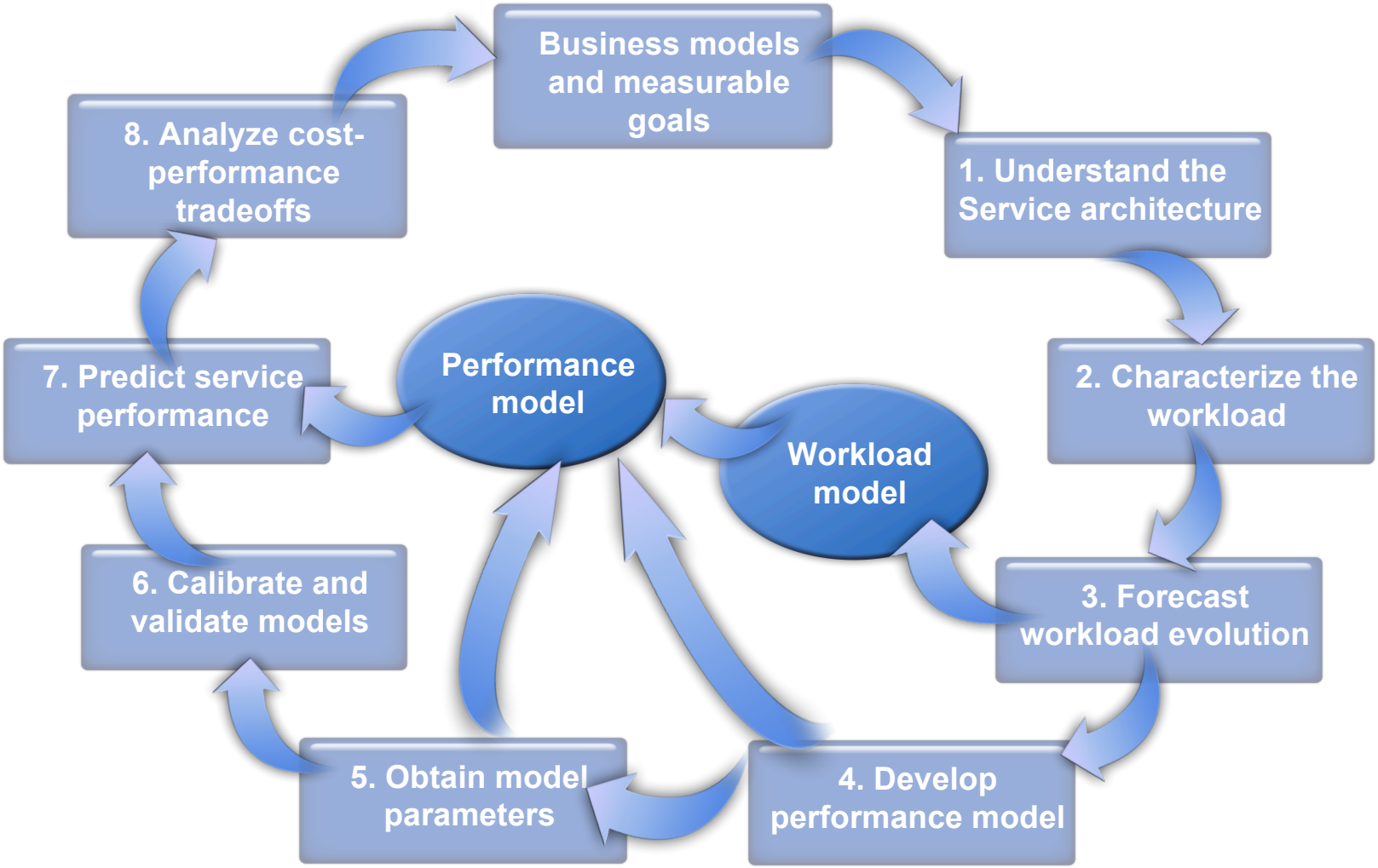
- The first tim online tax lodgement service is integrated with medica cost system
- Assess performanc of a new, hi profile e-government services



Phase


Phases
Requirement
Design
Development
Testing
Deployment
Operation
Evolution
Models
Workload Models
Performance Models
Performance testing and capacity planning carried out at individual government agencies
e-PASA Approach
Accuracy, Complexity and Cost of Modeling Process

Capacity Planning Process

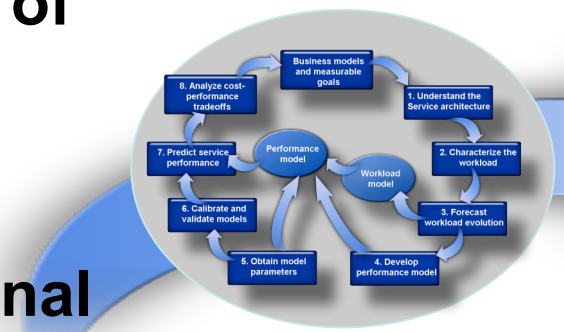


Challenges

- **Complexity of service architecture**
- **Complexity of the Web service scenarios**
- **Compositional performance assessment**
  - Each Government agency was only able to test the various components of the new service in isolation but not the integrated end-to-end service
- **Difficulties in performance measurement**
  - differences between the test environment and the production systems
  - Operation of some parts of the system is outsourced
  - discrepancies in measurement and estimation from different sources

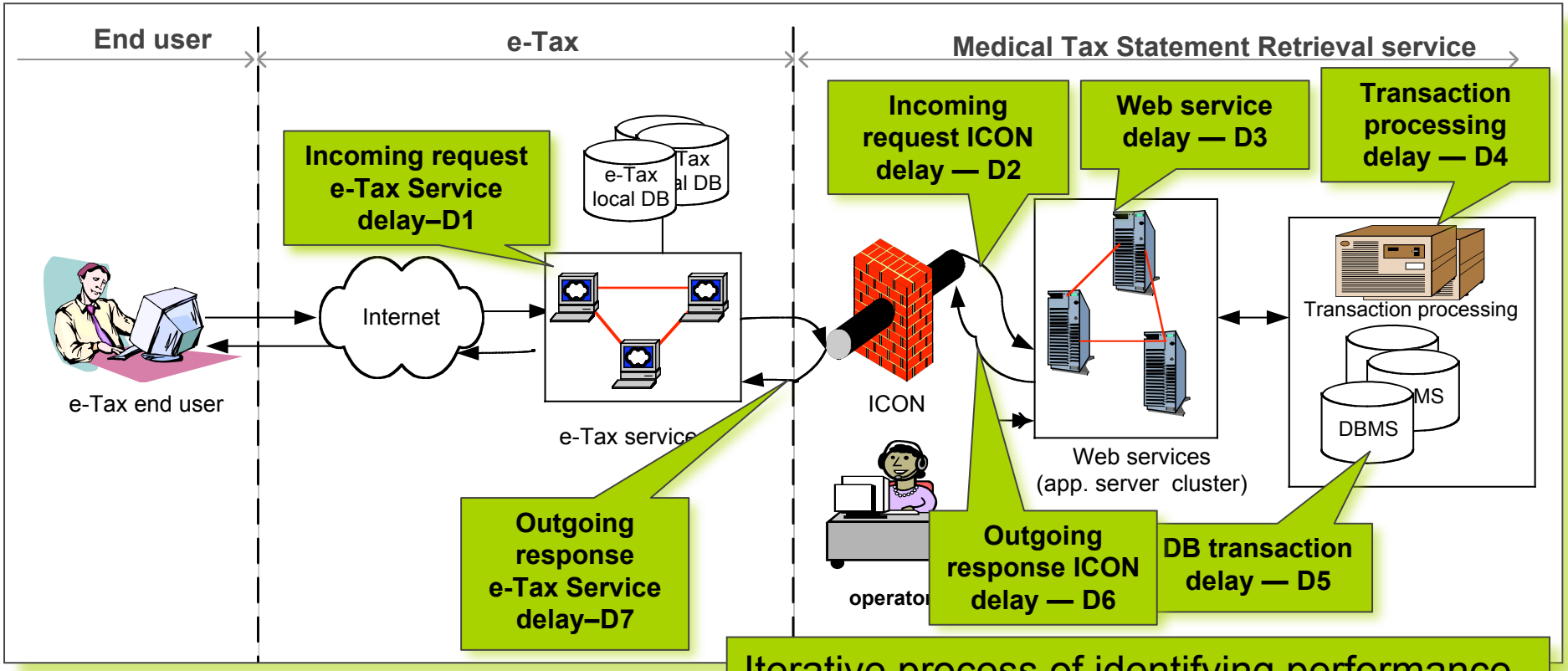
Approach

- **Complexity of service architecture**
- **Complexity of the Web service scenarios**
- **Compositional performance assessment**
- **Difficulties in performance measurement**



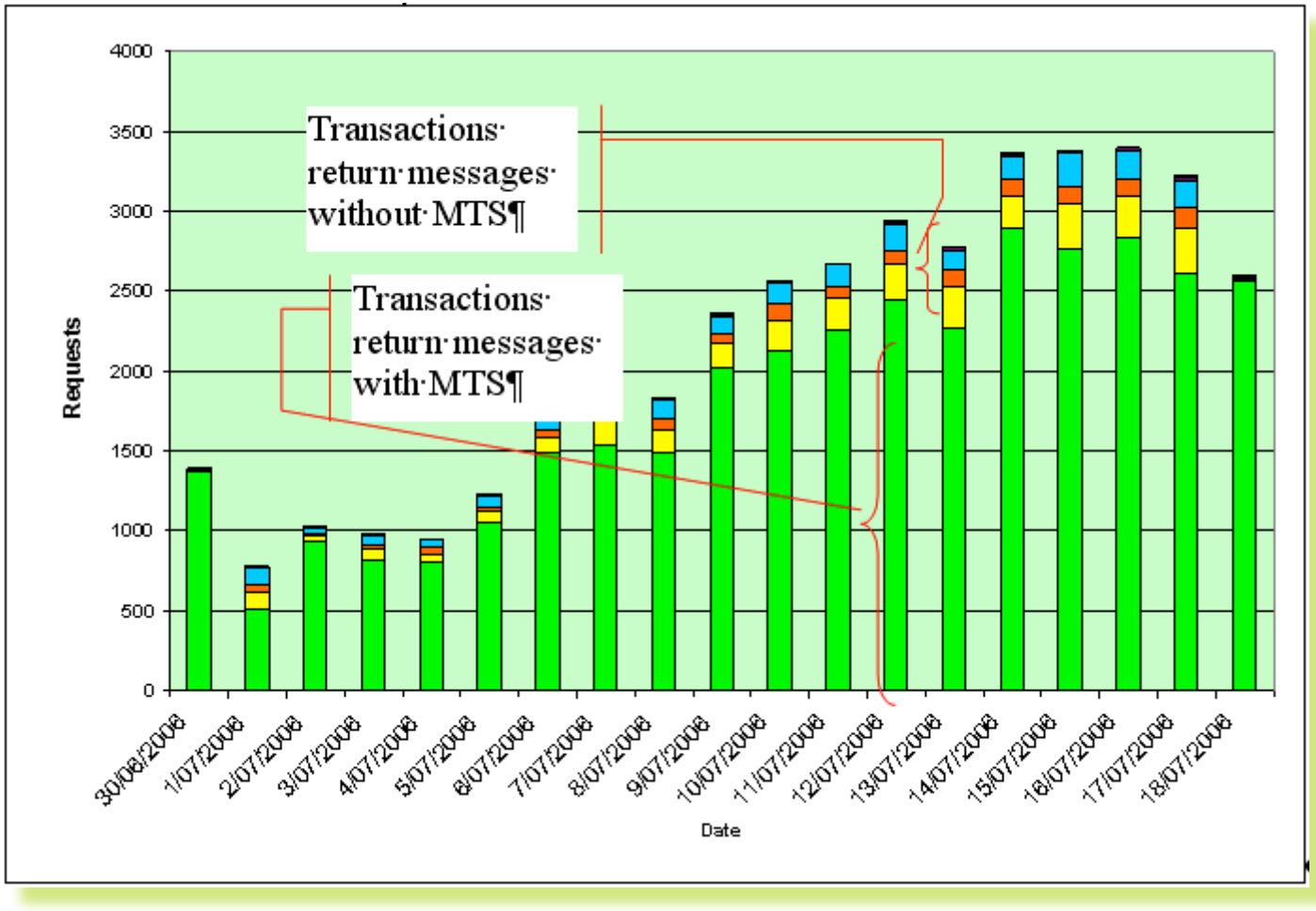
- **Determine the abstraction level**
- **Workload characterization**
- **Layered Modeling approach**
- **Use approximation**

Understand the Service Architecture

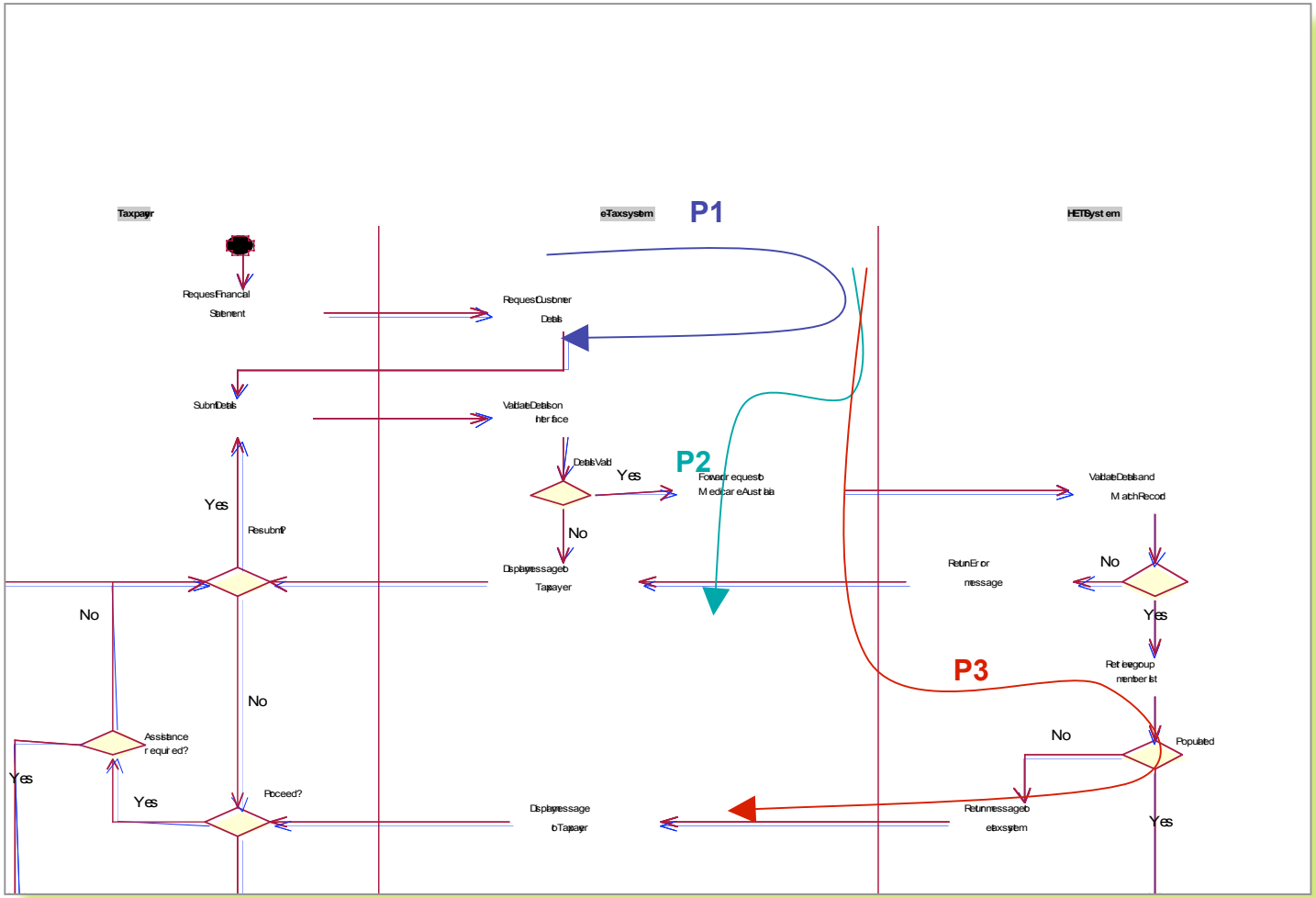


Iterative process of identifying performance critical architecture components and communications

Understanding the Web Service Workload (1/2)



Understanding the Web Service Workload (2/2)



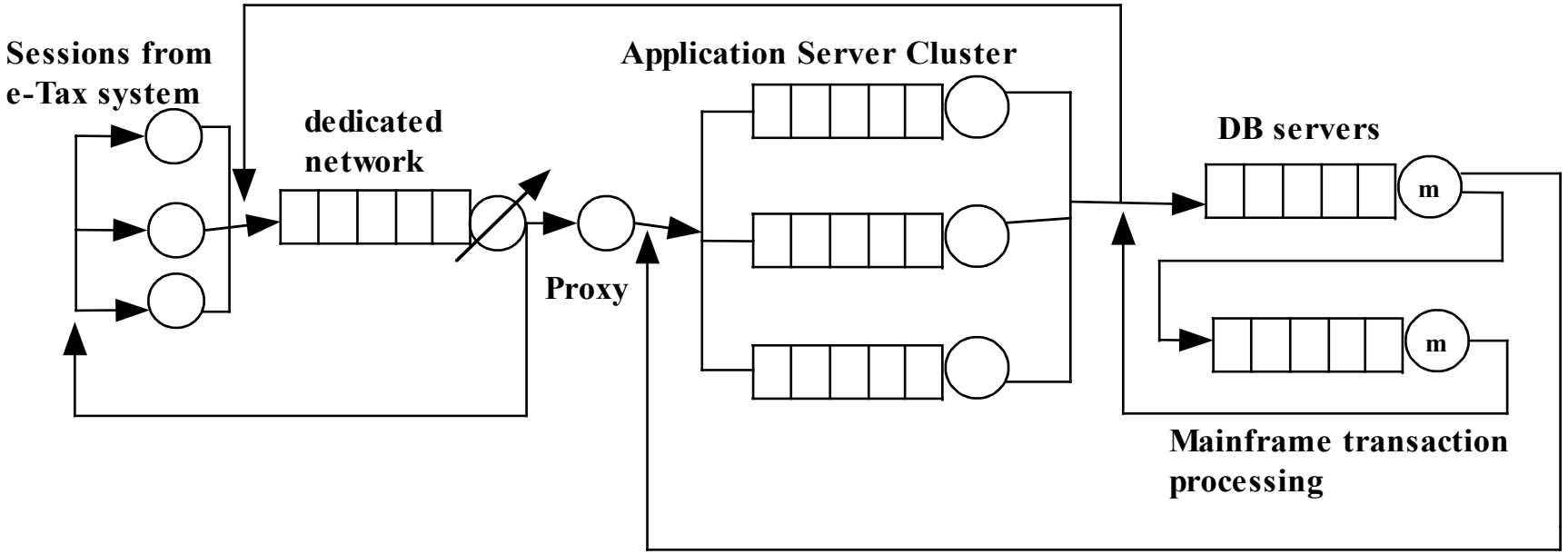
Characterize the Workload

- We need to characterize the workload that drives the runtime behavior of the system
- Understand workload pattern
  - Characterize navigational patterns within sessions
  - Characterize the rate at which different types of sessions start

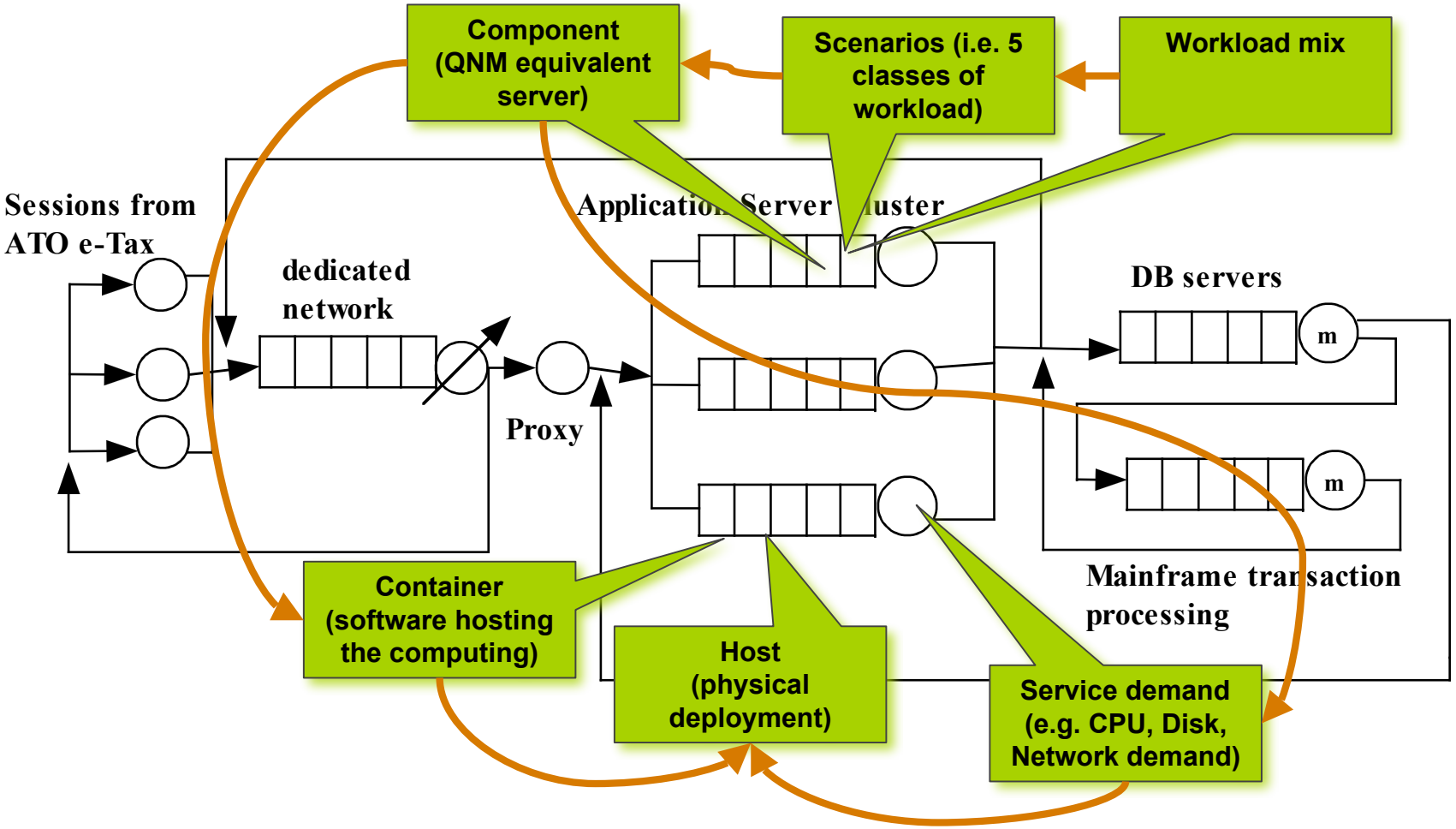
Workload characterization is based on the transaction mix pattern (group into 5 classes of workload)
- Transactions that return MTS
- Transactions that only return messages without MTS
  - Errors of user inputs, eg mismatched card numbers or other details

Devising Baseline Model

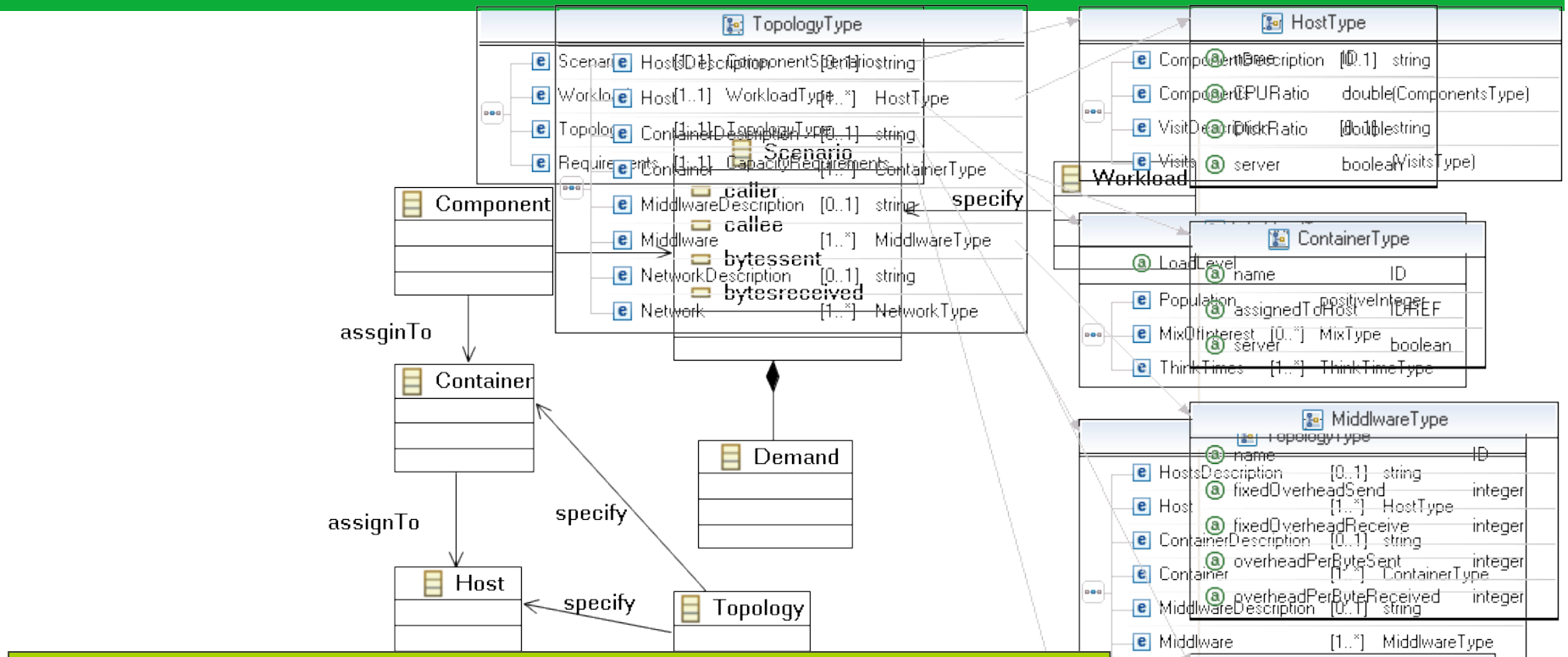
- 4 layers: sessions from the tax office, dedicated network, application servers, database servers and transaction processing systems
- a delay queue is introduced for proxy and load-balancing
- Multi classes of workload
- Mixed type of *server* (*resource center)* behaviors



Refining Baseline Model : Decomposition



Model Transformation and Solution



The model is presented in XML format
The model is iteratively solved using approximate MVA algorithms
Simplex algorithm is applied to find optimal configurations

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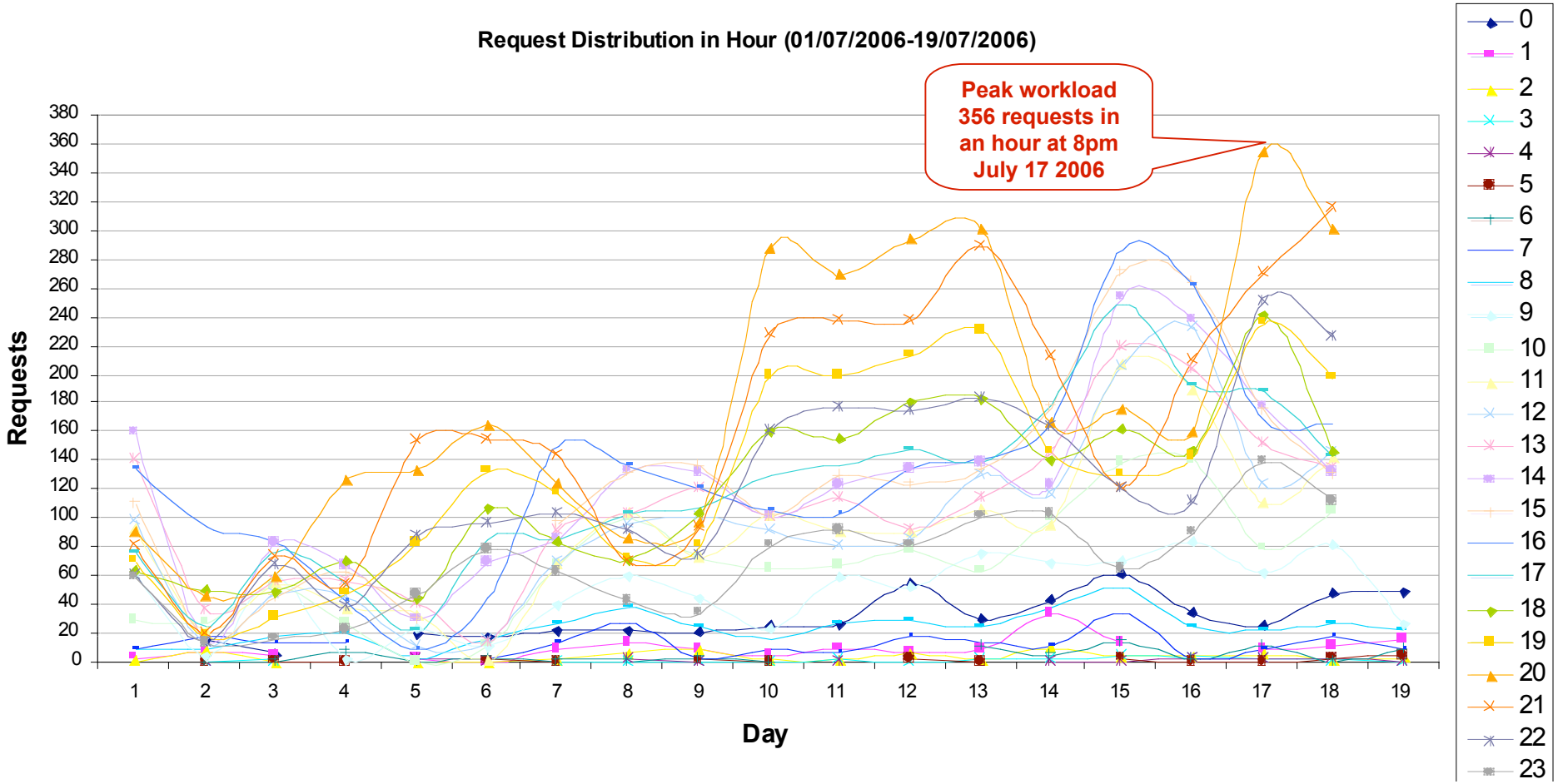
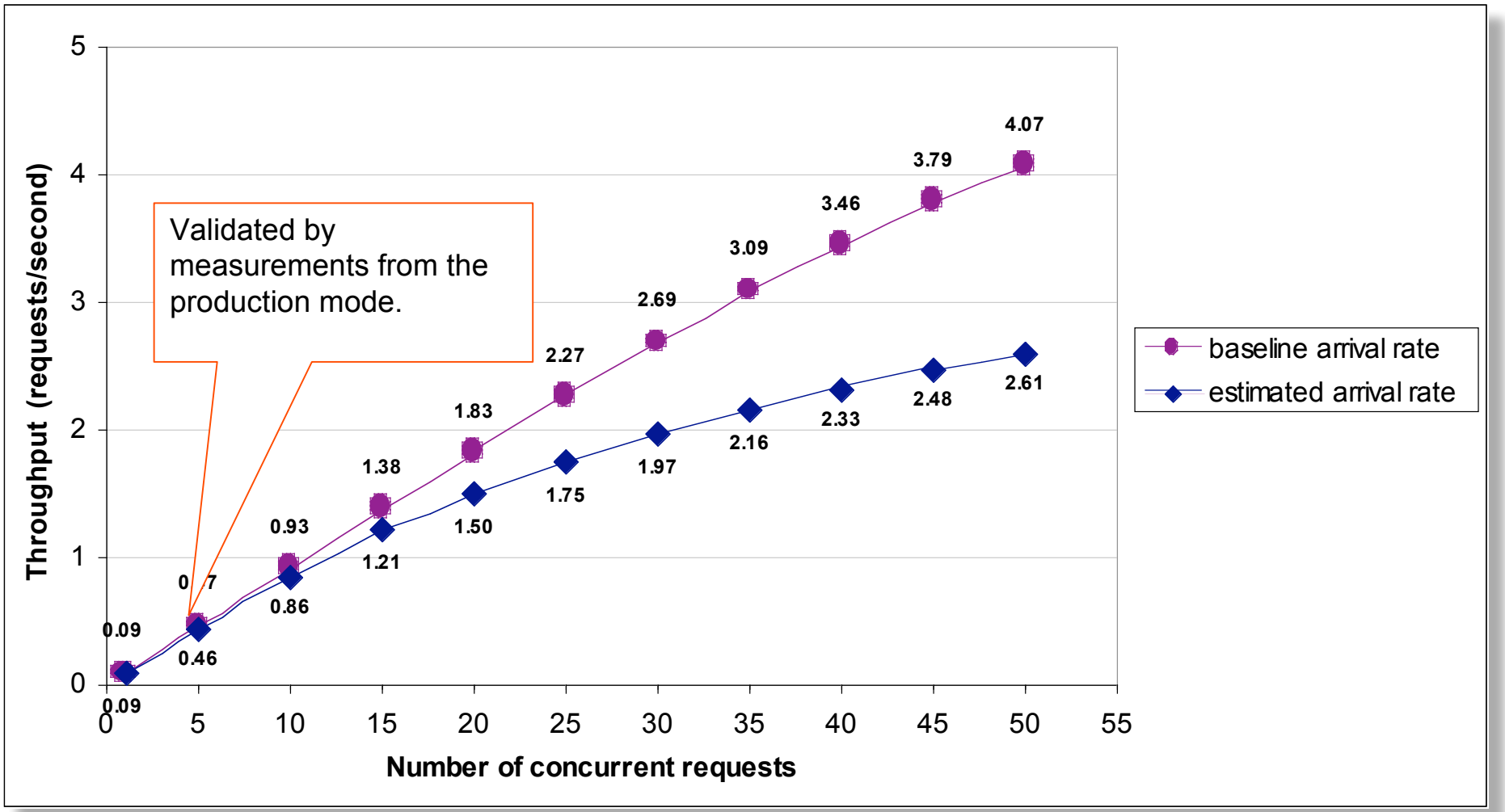
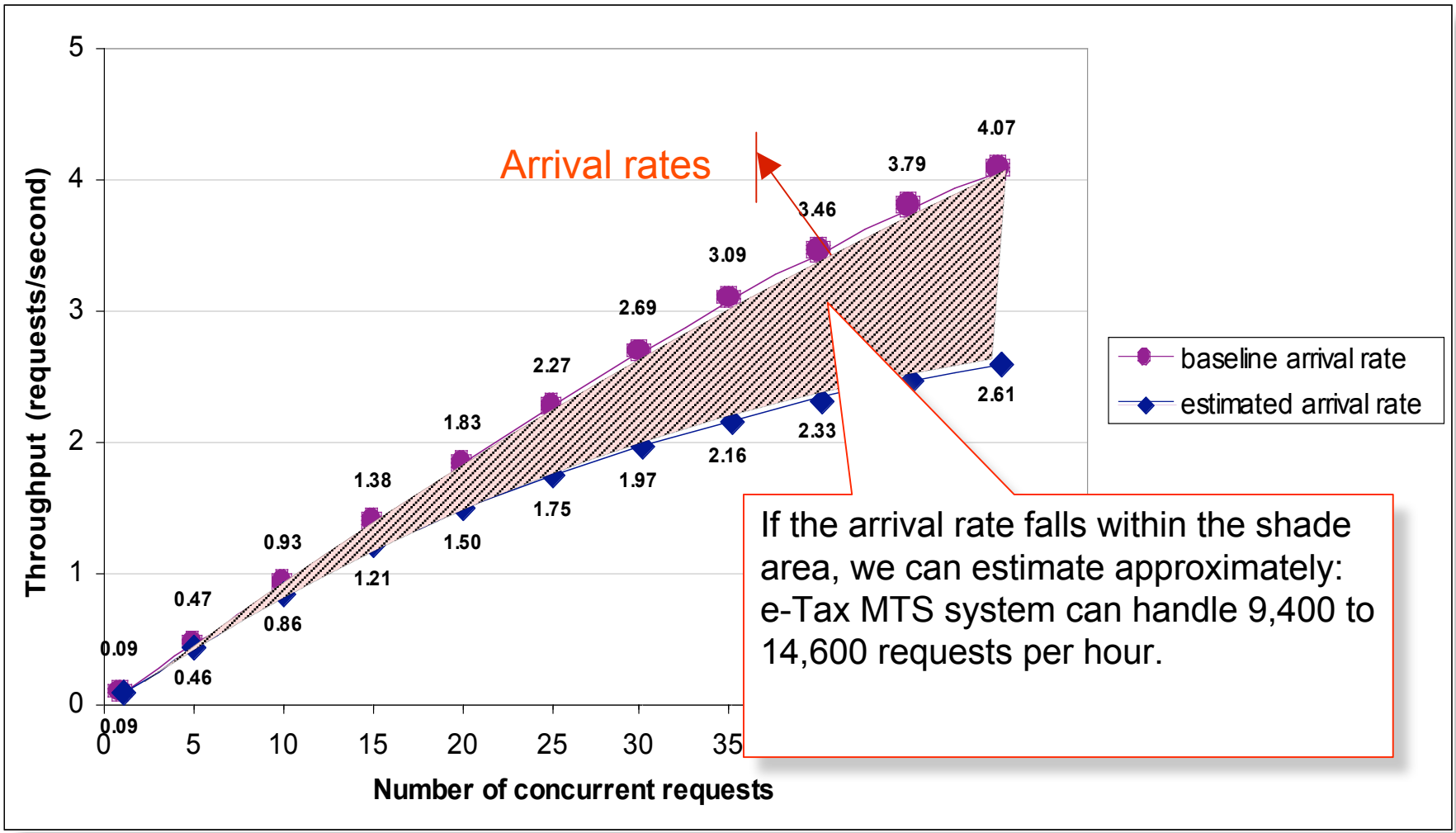
Validate the Baseline Model



Throughput Under Different Workload Levels



How to Interpret the Results?



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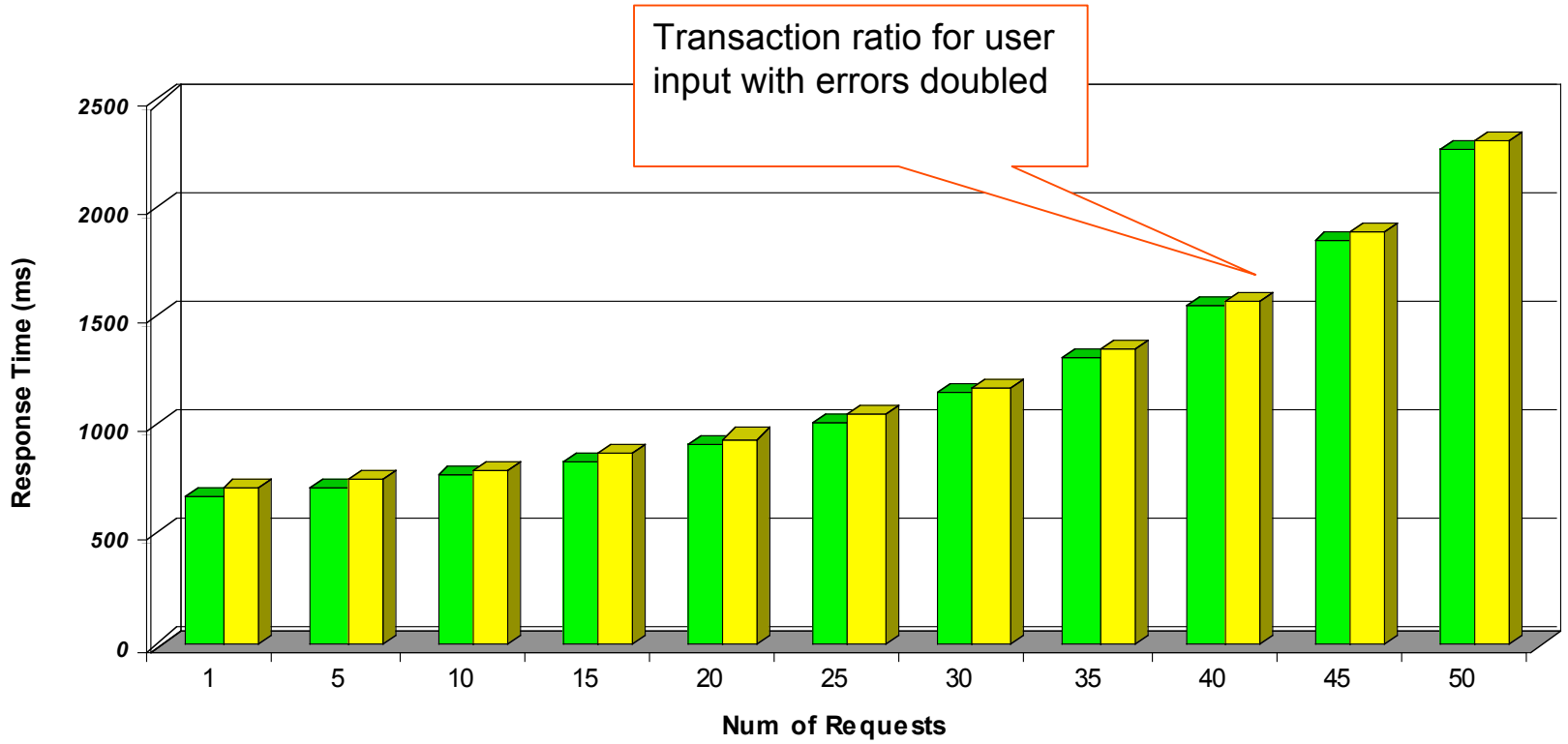
What-if Analysis : *transaction ratio for user input with errors doubled*



Lessons Learnt

- **Prediction**
  - *Limited model validation opportunities*
  - *Work with coarse-grained data*
  - *Work with incomplete measurement data*
  - *Work with limited architecture visibility*
- **Measurement**
  - *A flexible test data generation tool is required*
  - *A high degree of measurement and prediction integration is required*
  - *A distributed unified measurement utility is required*
  - *Time series data is essential for interpreting results*

Conclusion

- The performance evaluation results were later verified and inline with observations from the production system.
- Approximate modeling solutions with simplified assumptions can produce help setup baseline models.
- The success of this project leads to further collaboration with other government agencies
- Ongoing research is under the NICTA eGovernment Project

  http://www.nicta.com.au/research/projects/egov

Thank You and Questions

Backup Slides

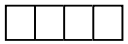
Basic Modeling Notations

se Queueing Network as the analytical performance model

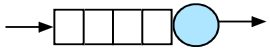
cheduling discipline is processor sharing (PS)

pplying MVA algorithms

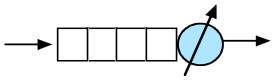
Server (resource)



Waiting room



Queue with load-independent server. The average service time of the server does not depend on the load.



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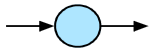

Delay server. The total time spent by a request at a delay server is the request's service time.