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Tales from the Crypt

Two Decades of Mission Critical Modelling

David Salt – HMG

Ericsson Modelling Days 2016

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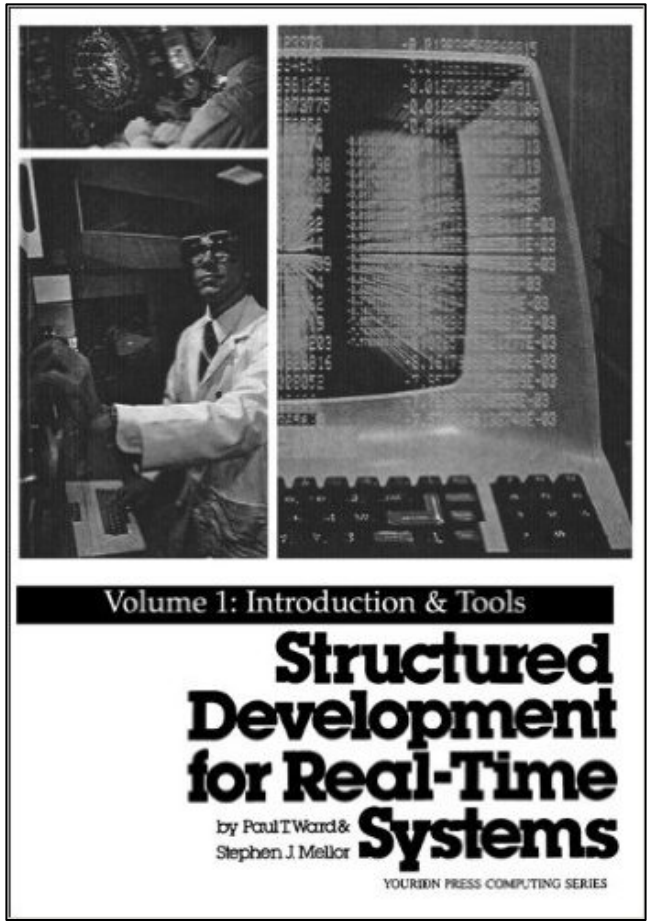
In the Beginning…

- Structured Analysis / Structured Design
- Elaboration of models into an implementation
- No object orientation



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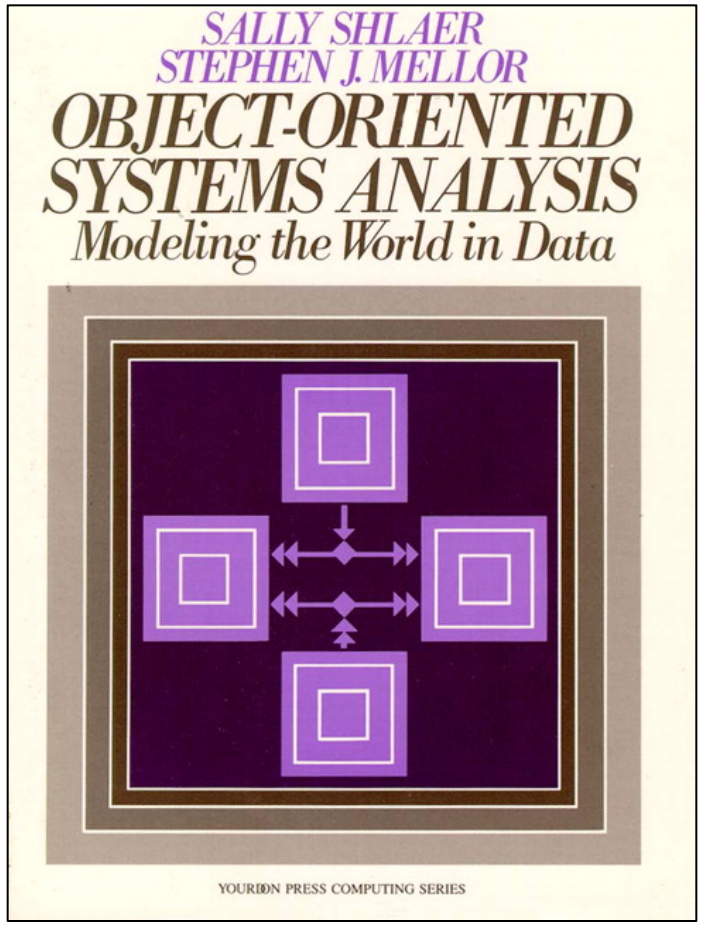
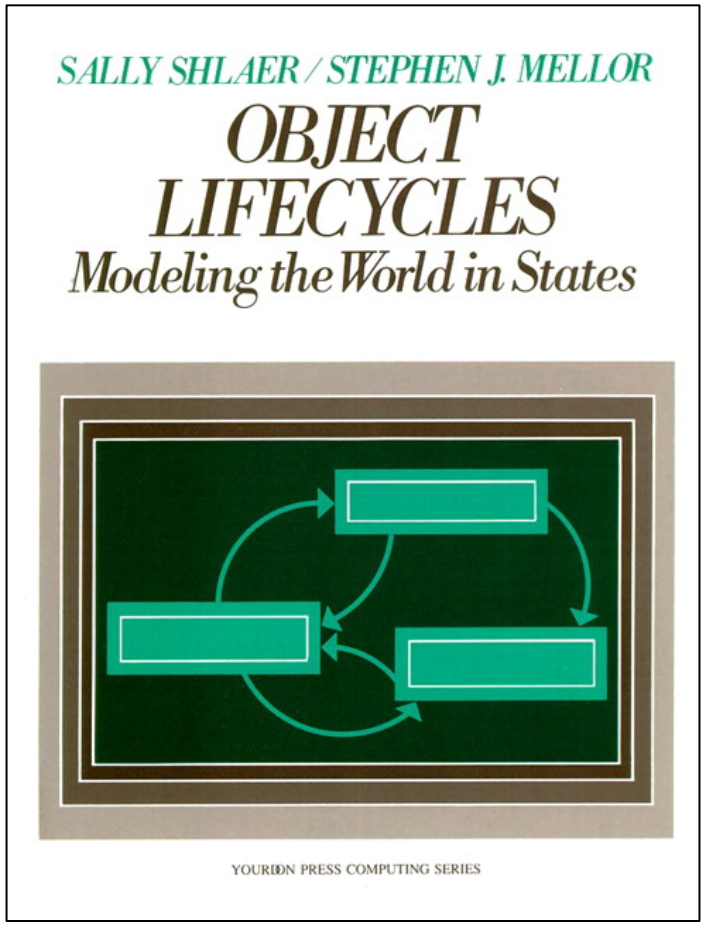
Shlaer-Mellor

- Methodology:
  - Models used to describe the system.
  - Rules to translate the models to the target.
- Kennedy Carter Limited:
  - CASE tool
  - Consultancy & training
  - “Target Architecture” Model Compiler.

Shlaer-Mellor





IOOA

- Built using a meta-CASE tool: IPSYS Tool Builder
  - Turned out to be a problem
- Shlaer-Mellor notation
- ASL, as the action language, was not tightly integrated
  - Turned out to be a benefit
- Supported the OOA97 Method
- Specific modelling features:
  - Synchronous Domain and Object Services
  - Domain Terminators and Inter-domain Bridges

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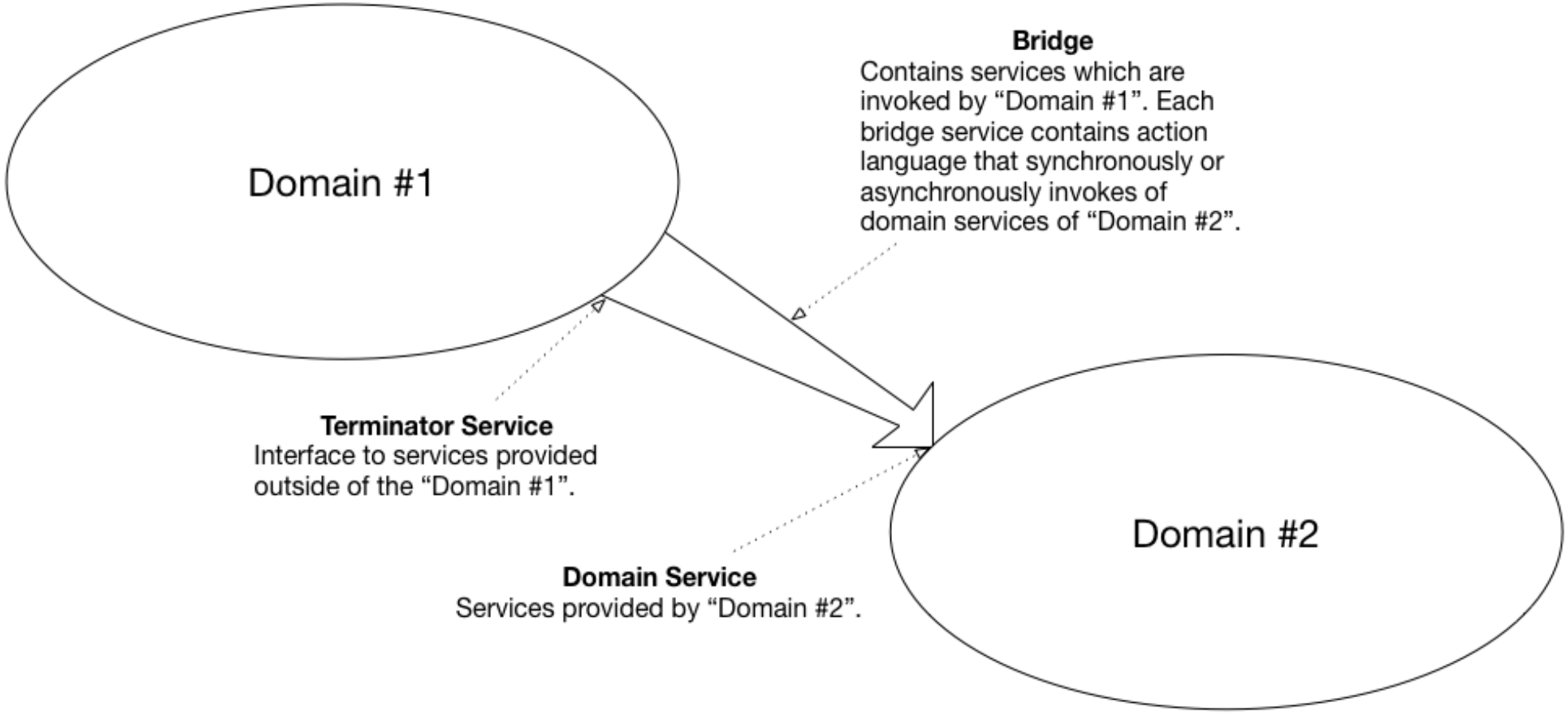
Bridges and Terminators



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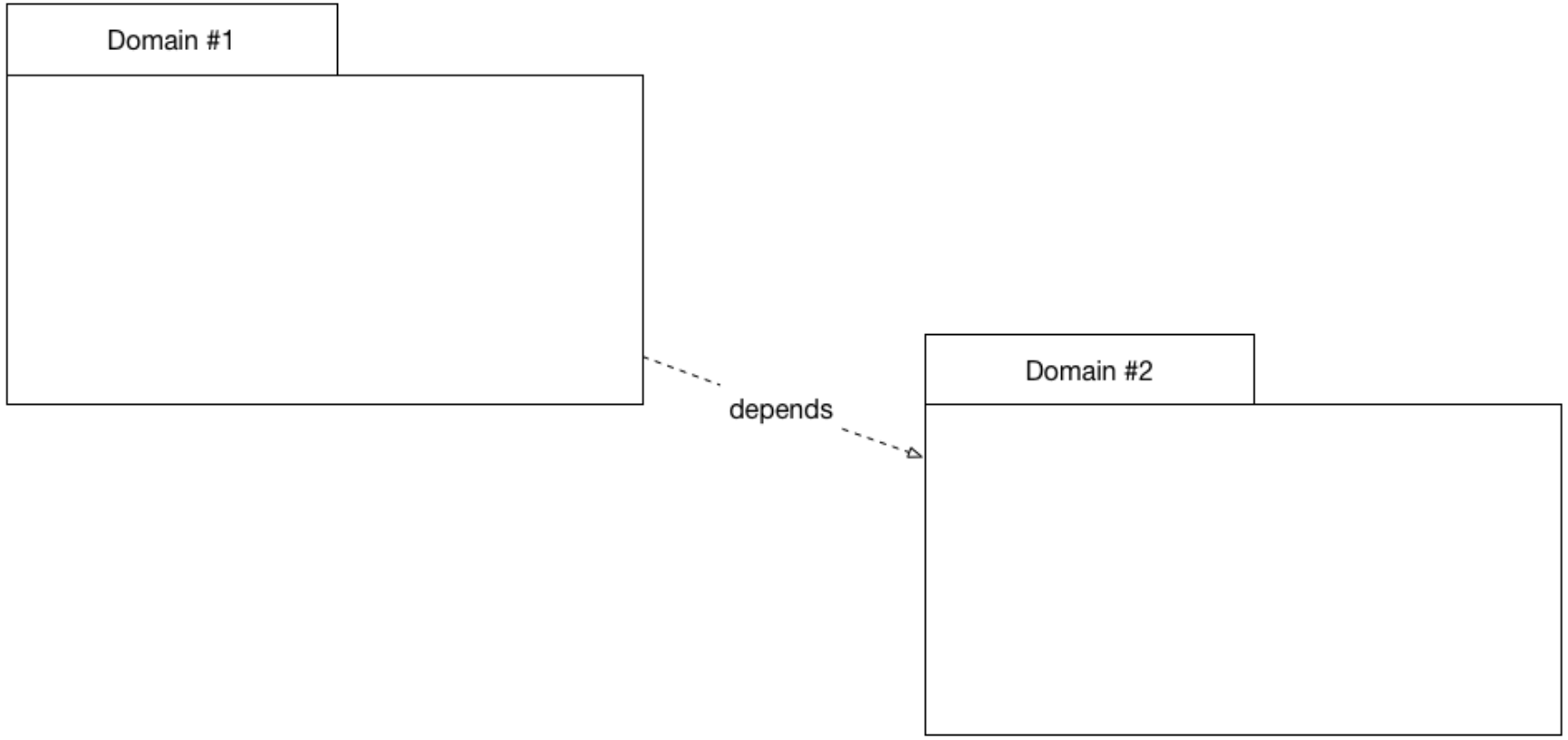
and in UML …



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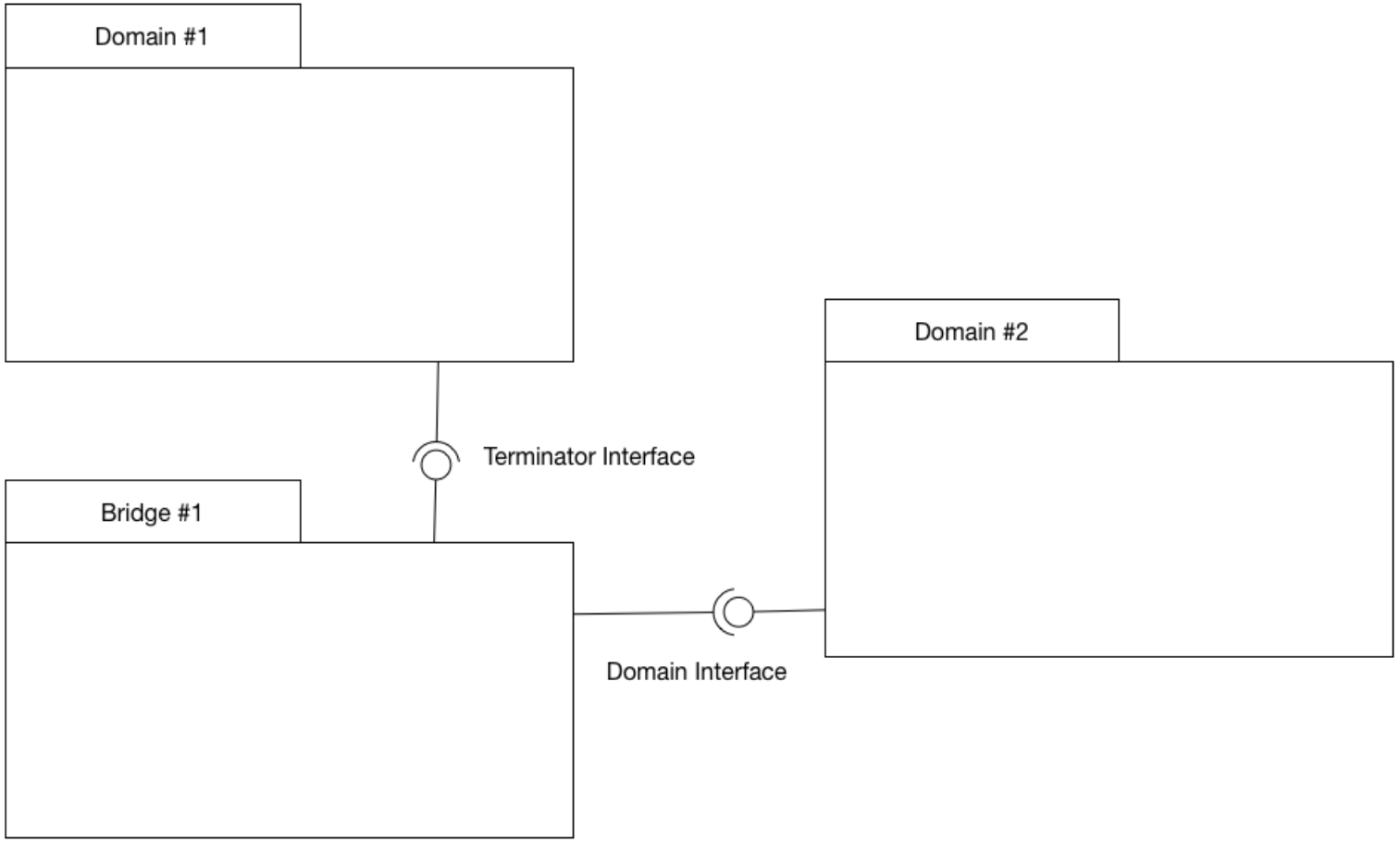
and more UML …



TA-1 & TA-3

- Target Architecture 1
  - C on OSF/1
  - Single Process
  - ASL Action Language
- Target Architecture 3
  - C++ on Digital UNIX
  - Multi Process
  - ObjectStore Persistance
  - ASL Action Language

Problems with ASL

- Weakly Typed
  - Spelling mistakes in variable names would define a new variable
- Rudimentary Flow Control
  - No “else if”
- Very Basic Type System
  - Limited collection types
- Does not describe the whole model
  - ASL only describes body of the state actions and services
  - Model structure represented by other information

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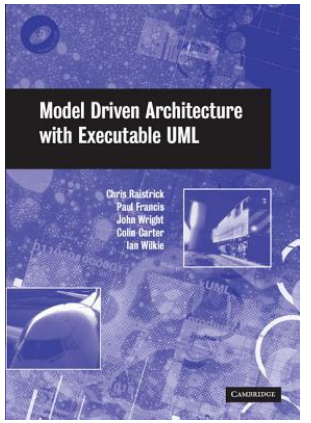
Change of Action Language

- New action language called MASL
  - ***M***odified ***A***ction ***S***pecification ***L***anguage
  - ***M***odel ***A***ction ***S***pecification ***L***anguage
  - Called *MODAL* in “Model Driven Architecture with Executable UML” by Raistrick et al.



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MASL Features

- Syntactically similar to Ada 95
- Describes the entire model
- Asynchronous behaviour
  - Instance and class Moore state machines
  - Polymorphic events
- Synchronous behaviour
  - Domain, terminator, class and instance services with in and out parameters
  - Functions with return types
  - Polymorphic synchronous services
- Strongly typed with collection types
- User defined types

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Action Language Examples

ASL

```
# a is an instance of Class A
a = this -> R1

# set_of_b is  a set of instances of B
set_of_b = b -> R2

# Alternatively ...
set_of_b = this -> R1 -> R2
```

MASL

```
instance of A: a;
bag of instance of B: bag_of_b;

a := this -> R1;
bag_of_b := a -> R2;

// Alternatively ...
bag_of_b := this -> R1 -> R2;
```

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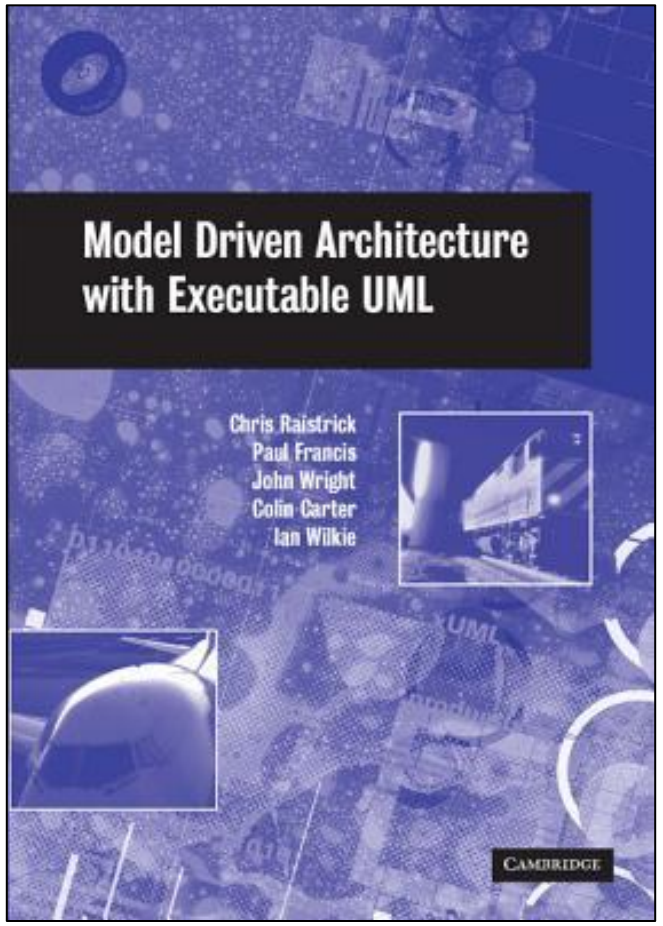
Move from ASL to MASL

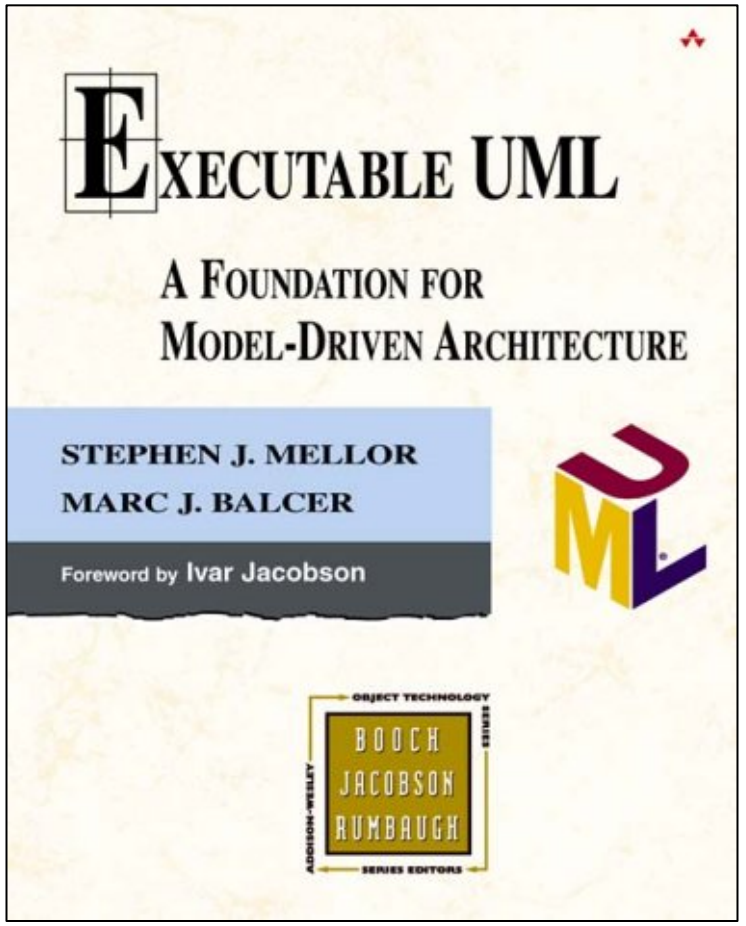
- The translation from ASL to MASL was automated via a custom parser and IOOA import tool
- A few ASL language constructs were flagged for analyst attention
- Revealed a lot of bugs and highlighted deficient test suites
- Improved the quality and reliability of the system
- Made the analysts life easier

Model Compiler

- Tru64 UNIX target platform
- Tru64 C++ Compiler
- Distributed C++ architecture with persistence
  - 64 bit ObjectStore persistence
- Inter-domain communication
  - MessageBus (in-house publish/subscribe middleware)
- Implemented in Java with ANTLR parser and AST
- Custom model extractor to navigate the IOOA “OOA of OOA” to produce MASL files

Executable UML





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Kennedy Carter iUML

- Still built with IPSYS Tool Builder
- Executable UML notation
- Updated user interface
- No other significant changes
- Our MASL integration and workflow continued to work

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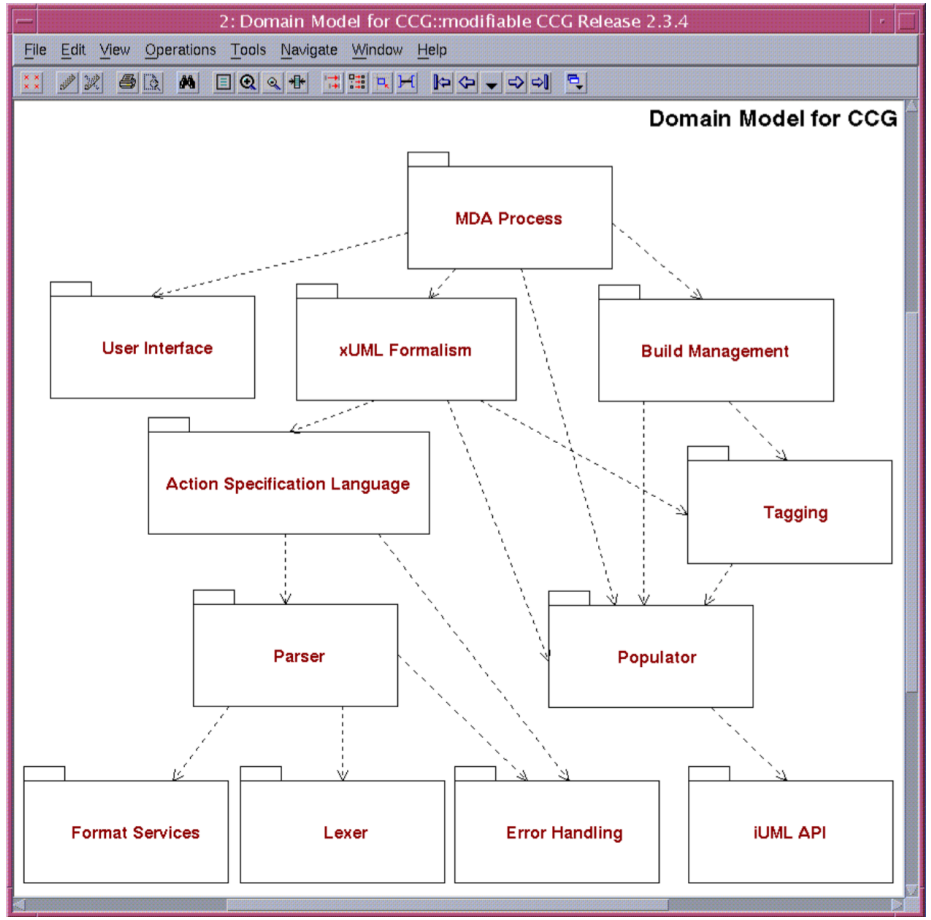

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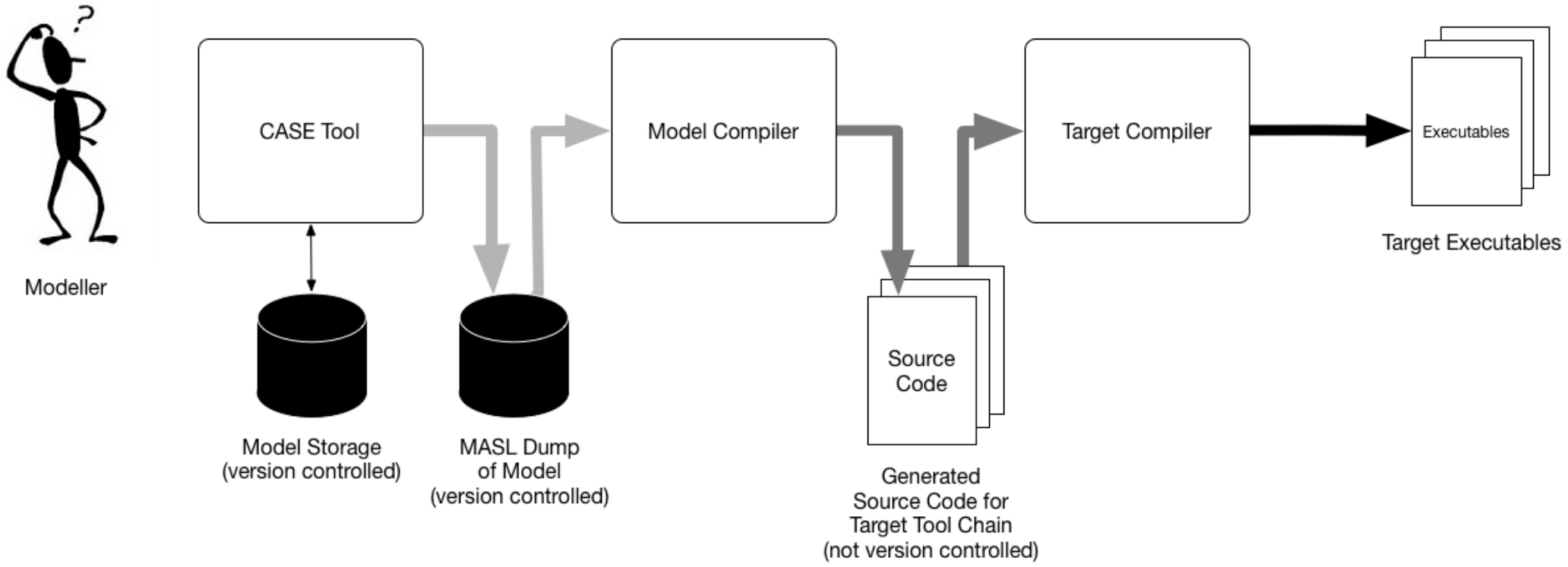
Enhanced Model Compiler

- Linux 32 bit and 64 bit target platforms
- Distributed C++ architecture
- Persistence of domains is supported via a persistence provider API
  - SQLite and vanilla SQL available
- Inter domain communications using an IPC API
  - Supports message durability
  - MessageBus and Qpid middleware available
- Native Services
  - “Wormholes”
- Timer event generate part of the language

Workflow



Domain Testing

- Test domain generated automatically by model compiler
  - Allows black box testing
  - Access to the timer & message event queue
- Test scripts held in the model
  - Black box test scenarios

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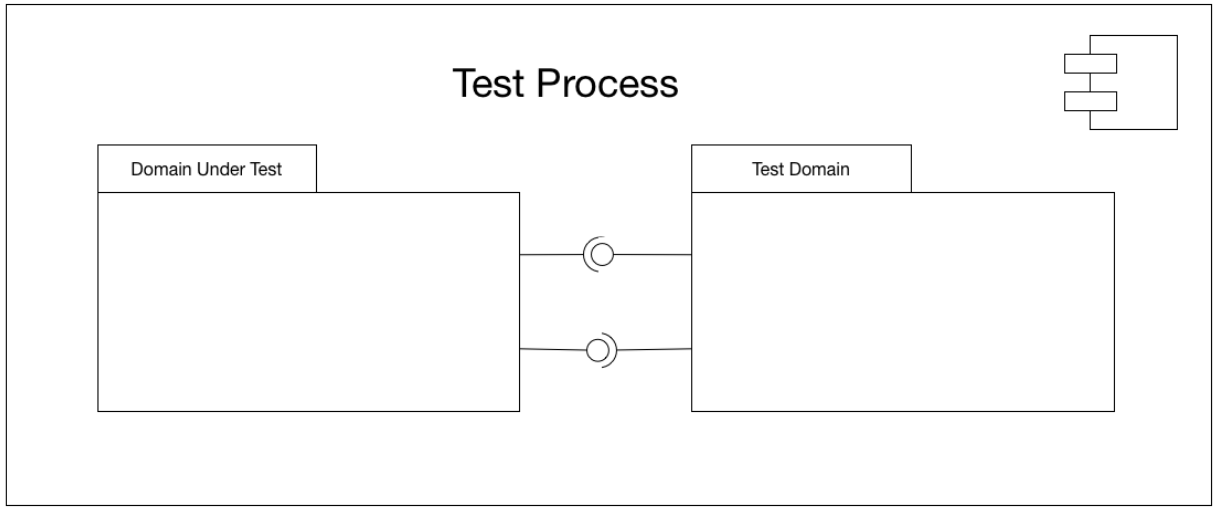
Domain Testing

- Test domain generated when each MASL domain is generated
- Test domain and target domain can be executed as a UNIX process
- Test scripts are interpreted by the test process to perform the tests.



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Debug Tools

- Inspector - model level debugger
  - Written in Java
  - Remotely connects to a executing process
  - Shows model
  - Allows action language level debugging
- Sniffer - message aware “Wireshark”
  - Written in Java
  - Remotely connects to the message fabric
- Snorter – message injector

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Debug Tools

- Inspector - model level debugger
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Move away from iUML

- Kennedy Carter Limited no longer in business
- Abstract Solutions Limited have not updated *i*UML for several years
- *i*UML has issues:
  - Runs on SPARC hardware
  - Not very reliable – crashes quite often

OneFact BridgePoint

- Working with One Fact Inc. to add MASL support to BridgePoint
  - Prototype available in version 5.3.4
  - Production release scheduled for the end of 2016
- Open sourced MASL related software
  - MASL language reference and ANTLR grammar
  - Releasable parts of the *i*UML dumper
  - C++ Model Compiler
  - Architecture runtime support
  - Inspector

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Organisational Adoption

- Some people just don't get it
- "*It's impossible*" or "*It'll never work*"
- "*Why can't I just write code*"
- The view that *agile* makes design unnecessary
- Maturity and industry adoption

Conclusions

- The original project contained 1.5 Million lines of generated code running on over 200 interoperating nodes that was maintained for over 12 years.
- Subsequently still in use on a number of other projects.
- The move to a strongly typed action language improved the quality of the system and it's reliability.
- Executable UML is still proving important now:
  - Small group of developers.
  - Pockets of interest elsewhere in the organisation.
  - Perfect for some our problem spaces.