

Case Study: Leveraging Industry Standards & Model-Driven Development for Enterprise Information Management **& Semantic Integration** at Long Island Power Authority (LIPA)

Predrag Vujovic, Phillip Jones, Fran Clark, Stipe Fustar







Arpeggio Technology



www.lipower.org

Topics



- Real-world Case Study of how LIPA are using a Model-Driven approach, leveraging an Enterprise Semantic Model (ESM) to:
 - Implement Semantic Integration
 - Implement Persistent Data Stores (e.g. for Analytics, Data Warehouses)
- Our Story:
 - LIPA Smart Grid Business Drivers (Why?)
 - Target Architecture and Enablers (What?)
 - Semantic Integration Approach (How?)
 - Persistent Data Stores (How?)

Foundation – Model-driven process



- LIPA has adopted a model-driven process for defining, designing, developing and deploying:
 - Services on the Enterprise Service Bus
 - Persistent data stores for analytics (ODS, Data Warehouse, Datamart)
- The Model-driven approach leverages industry standards (e.g. CIM) wherever possible to:
 - Promote reusability
 - Accelerate development cycles
 - Facilitate visibility, governance and change management
- Four key models
 - Enterprise Semantic Model
 - Service Model
 - Exchange Model
 - Data Model
- Process & Governance

ODW Conceptual Technical Architecture







LIPA Smart Grid Road Map



LIPA Standards & Model Driven Approach

LIPA Model-driven Architecture Business Drivers



- Reduce cost of implementations and integrations
 - including maintenance / change management
- Reduce risk to implementations and integrations
- Increase speed of implementations and integrations
- Improve ability to solve business problems by choosing best of breed applications and services
- Avoid vendor- and technology lock-in's
- Support Multiple Service Providers
- Architecture:
 - "Near Plug and Play", Flexibility, Agility & Portability
 - Consistent semantics for data in-flight and persisted for analytics
 - Flexibility of Business Intelligence Options
 - Open to new technology, solutions, applications
 - the key to leveraging investment in Smart Grid infrastructure and many new players, functionality, data consumers & -producers

LIPA Model-driven Architecture Business Drivers



- Accomplish this by:
 - Establishing a loosely-coupled SOA architecture through :
 - Leveraging an Exchange Model (EXM) for model-driven "development", that ...
 - mediates all interfaces through a LIPA Enterprise Semantic Model (ESM), ...
 - which is based on available industry standards (e.g. CIM)
 - Using a model-driven design and development process to:
 - Speed development process
 - Improve reusability
 - Improve governance and change management
 - Require that any new vendor applications:
 - Where possible, conform to LIPA canonical interfaces
 - When not possible, conform to some industry standard interface
 - Publish interfaces / APIs so that knowledge of underlying database structures is not required for integration (transactional or analytical)

LIPA Model-Driven approach



- End-to-End Model-Driven approach
- Paradigm Shift compared with the conventional approach
- Bridges the gap (chasm?) between design, development and run-time
- Increased Agility, Responsiveness, Speed
- Decreased Time, Cost, Risk
- Enabler for implementation of new functionality, processes and analytics solutions

LIPA Integration & Standards History



- LIPA started pilot projects in utilizing industry standards for interoperability of systems in 2000
- LIPA Recognized the need for an innovative model-driven approach in 2007
- LIPA's New Model-Driven Approach :
 - Enables semantic integration through the use of a common semantic model
 - Supports "automated" maintenance, testing, and updates of enterprise data model across company systems



Projects Track Record

- Projects comprised integration solutions and persistent data stores (ODS's and Data Warehouses)
- The LIPA Model-Driven Semantic Integration approach has consistently performed under budget and on time under complex and challenging conditions.
- Trend of reduced cost and improved delivery speed is based on:
 - Model-driven approach + governance + processes + tools for
 - "automated/integrated" development, testing, implementation, and maintenance of the model
 - Reuse of data and interfaces across company systems and SOA

Projects Track Record



- Projects completed & in-flight include:
 - Energy Trading Solution
 - Customer Outage Communication (Web Outage Map)
 - Customer Outage Communication (Text Messaging)
 - Meter Data Management
 - Outage Management (OMS in progress)
 - Customer Consumption Data integration

Model-driven Workflow : "Lossless" Metadata





Key Elements of LIPA Semantic Integration



- Centrally Managed Semantic (Data) Model (ESM)
 - Heterogeneous interfaces mediated through common model
 - Based on industry standards (IEC CIM)
- Centrally Managed Exchange Model (EXM)
 - Semantic Mapping and Business Rules
 - Integrate & Reuse Business Rules, transformations, mappings
 - Automate gap analysis, documentation
 - Centrally Managed Mapping and Run-Time Deployment
 - Generate ready-to-go SOA services (Deploy the Model, <u>No</u> code written)
 - Continuous testing
 - Deploy into any Java runtime environment
 - Automate impact analysis on change

Semantic Integration Value Proposition



- Make all run-time interoperability decisions at semantic layer
 - Configuration rather than coding
 - Automate implementation
 - Simplified testing
 - Test mappings, transformation and business rules using design-time tool (DXSI)
 - Effective change management, maintenance and updates!!!

LIPA ESM and Integration Concept





LIPA Data Warehouse, BI and Reporting Business Drivers



- LIPA Data Warehouse Key Requirements and Drivers
 - Provide business users with rapid, reliable and consistent access to information for making business decisions
 - <u>Business Intelligence</u> (Historic perspective) uses ESM-based data warehouse
 - Provide data mining features at ODW or DM level for various analyses (e.g. statistical, time series)
 - <u>Operational Intelligence (near-real-time perspective, which includes</u> Visualization tools) utilize ESM-based near-real time data store, ESM-based data warehouse and Canonical data services.
 - Gain efficiencies by eliminating need for business users to reconcile semantic interpretation of data
 - Show value in near-term but build to support future
 - Support both event-driven and batch-oriented data and process integration, as required.
 - Leverage existing and future data services for ensuring minimal latency between data in applications and the data warehouse / datamart / ODSs'

Logical View of LIPA Analytics Vision





Model Driven Approach Integration Services & Persistent Datastore (Database) **Design – Develop – Deploy Cycle** (information perspective) **Run-Time Design- & Development**



LIPA Standards & Model Driven Approach

Governance and Change Management



- Guiding Principles
 - Models are central to all governance and change management activity
 - Automated processes will be used to reduce effort and errors
- Change Management
 - Version and Source Control Process for managing and packaging changes to services
 - Defect Fixing
 - Enhancements
- Governance Process for managing all of the above and insuring highest quality and reusability
 - Design Time checks and controls to insure best possible design prior to implementation
 - Runtime enforcement of defined policies



Meta Model for Service Model Realized in the LIPA Service Taxonomy





Key Take-Away Points



- Innovative Integration approach with benefits of
 - "Near Plug and Play" for systems and Analysis Solutions
 - Model Driven Development, End-to-End
 - Benefits of automation for integration, testing, maintenance, updates
 - Significantly Lower Life Cycle Cost and more effective system deployments
- Model-driven approach that leverages Industry Standards (CIM) for interoperability
- Scalable (Structured, planned, model-driven approach)
- Semantic understanding is guaranteed (explicit, not implicit);
 - availability of strongly typed syntactical interfaces is not a requirement for success any more
- Easier updating and tracking of standards development

LIPA Standards & Model Driven Approach

Thank You

- Predrag Vujovic
 - pvujovic@lipower.org
- Phillip Jones
 - pjones@xtensible.net
- Fran Clark, Arpeggio Technology
 - fclark@arpeggiotech.com
- Stipe Fustar
 - sfustar@powergrid360.com







