Private Cloud Services at the Enterprise Level

Prepared by: Bill Thirsk,
Vice President of Information Technology/CIO
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The Joint Study

A Unique Research Partnership with IBM

- IBM / Marist Partnership supports students of all disciplines throughout their academic career

- Marist participates in the IBM Value Chain as both a contributor and as a consumer
  - Research
  - Teaching and Learning
  - Scalability of operations and efficiency
  - ISV ‘lift and move’ development, testing, and operations

- Original research projects started in 1988

- Our Return on Assets Model has been proven with massive virtualization and non-similar workloads
"Over 70 years ago, President Franklin D. Roosevelt called for 'the duplication of records by modern processes' to ensure the long term survival and accessibility of our nation's historical heritage," said Archivist of the United States David S. Ferriero. "With the launch of FRANKLIN, the Roosevelt Library – in partnership with Marist College, IBM, and the Roosevelt Institute – has taken a huge step in realizing FDR's vision."
Projects and Partners
The Marist Institute for Public Opinion

- Nationally Recognized Center Founded in 1978
- Provides Scientific Surveys
  - Elections
  - Policy issues
  - Human interest topics for the public
- Provides Unique Student Educational Opportunities
- Exploring Innovative Internet Survey Techniques
- State-of-the-Art Predictive Dialing
- Dedicated Marist Poll fiber optic video link between Hancock and a media hub located in NYC
  - Provides live, broadcast quality TV from Marist Poll Survey Center to any one of the television networks
Shared Services for System z
*z/OS Knowledge Center on System z*

IBM Knowledge Center

327 Schools

1,417 Courses

z/OS

z/OS 90 Images

24,050 Students

734 Faculty

z/VM

z/VM 15 Images

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Partnering Effectively – Higher Education

Enterprise Computing Community (ECC)
- Illinois State University
- North Carolina A&T
- Widener University
- University of Arkansas
- Monroe College
- San Jose State University
- Stevens Institute of Technology
- Binghamton University

Gates Foundation, Academic Analytics
- Cerritos College
- College of the Redwoods
- North Carolina A&T
- Savannah State University
- North Carolina State University
- JISC (The United Kingdoms version of the NSF)
Partnering Effectively - Corporations

- Enterprise Computing Community (ECC)
  - AETNA
  - Bank of America
  - BMC Software
  - CA Technologies
  - Citigroup
  - IBM Corporation
  - Morgan Stanley
  - Progressive Insurance
  - The Travelers Companies
  - Verizon

- Research and Incubation
  - ADVA
  - Big Switch
  - Brocade
  - Ciena
  - IBM Corporation
  - Juniper
  - NEC
  - BlackRidge Technology
  - TeliStat
The Joint Study
A Unique Research Partnership with IBM

- Joined Sakai Foundation Learning System for Greystone
- WAS/DB2 Integration with Sakai Open Source CLE
- Marist Cloud: The College began offering Private Cloud services at scale from the z
- Academic Analytics
- IBM announcement of the LinuxONE mainframe

Timeline:
- 2006: Banner on z Higher Ed ERP launched on z
- 2009: Cognos Rational Cloud / Virtual Analytics Computing Lab Project
- 2010: Pre-configured multi-tier Business Analytics Instructional System
- 2012: SDN OpenFlow Project
- 2013: With the Joint Study team, Marist began work on Software Defined Networking technology
- 2015: Marist designated a Center of Competence in Cloud Computing and Analytics by New York State
- 2017:

- #4 Loyola University (165)
- #9 Marist (88)
New York State Centers of Excellence

Binghamton University
Small Scale Systems Integration and Packaging Center (S3IP)

Syracuse University
Center of Excellence in Environmental and Energy Systems

University at Albany
Center of Excellence in Atmospheric and Environmental Prediction and Innovation

Stony Brook University
Advanced Energy Research and Technology Center (AERTC) and Center of Excellence in Wireless and Information Technology (CEWIT)

University at Buffalo
Center of Excellence in Bioinformatics and Life Sciences (CBLS) and Center of Excellence in Materials Informatics (CMI)

Rochester Institute of Technology
Center of Excellence in Advanced & Sustainable Manufacturing (COE-ASM)

Center of Excellence in Nanoelectronics and Nanotechnology (CENN) and Smart System Technology & Commercialization Center (STC)
"The board of Trustees of Marist College strongly believes that the competitiveness of private comprehensive colleges and universities depends on developing new business models and collaborating in new ways with like-missioned partners. Our board has made a long-term commitment to support the development and operation of the academic community cloud to meet our goal of partnering to develop new methods to improve student engagement and outcomes, streamline administrative practices, and lower the total cost of technology management across the academe."
Mission for Marist Shared Services

To engage in special projects with like-missioned organizations to jointly lower the overall cost of high performance technologies and services so affiliated participants may redirect precious resources to their primary mission.
Shared Services Model

Candidates for Participation

- Colleges, universities, schools, and organizations with core missions that do not include active technology management

- Organizations that are not experiencing the efficiencies offered by state-of-the-art computing equipment and technology management methodologies

Challenges

- Can the technology overhead be reduced while still offering great services or expanding services?

- Is moving to open, public cloud systems appropriate or affordable?

- Can continued investment in a non-strategic infrastructure be sustained?

- Is a consortia model better than a one-to-one customer/vendor relationship?
Academic Community Cloud

Conceptual Overview
The Marist Services Cloud

Sakai
Paywall
Liferay
Calendar
OpenFlow
ellucian
Jobs
pentaho
Appointments
Spark
Alerts
Digital Archives
The Marist Shared Services Cloud
Cloud Enabled Banner ERP System

- First to run Ellucian Banner on Linux on System p and System z
  - First and only research license to move Banner, Luminis, and other Higher Education ERP Software Applications to the System z platform

- 2010 NACUBO Innovation Award for being the first to implement Banner on the System z

- College of New Rochelle 2015 NACUBO Innovation Award Recipient
  - Successful implementation of CNR’s Liferay Portal, MyCNR
    - “Shared Services” with Marist as an innovative strategy
    - Banner fully implemented
College of New Rochelle (CNR)

- CNR.EDU went live on December 1, 2014
  - Two months ahead of schedule
  - Public-facing Websites
  - Intranet

- Full Banner Implementation
  - Hosted
  - Managed
  - Add-ons (e.g., TouchNet)

- DegreeWorks
  - Integrated
  - Hosted
  - Managed

- Marist and CNR are taking advantage of economies of scale to provide both institutions savings
New England College (NEC) - DegreeWorks

- Fully hosted and managed DegreeWorks
  - Integrated with on-prem Banner
  - Leverages the open-source Enterprise Service Bus (ESB) developed at Marist

- Marist and NEC are taking advantage of economies of scale
  - Provide both institutions savings
The College of Saint Elizabeth needed to move toward a fully integrated portal
- For content management of public-facing website
- To better keep constituents engaged in real time using Saint Elizabeth’s Intranet

Marist will provide a fully hosted instance of the open-source web system, LifeRay
- Will integrate their systems using APIs and our cloud’s Enterprise Service Bus (ESB)

Marist will integrate new systems used by the College of Saint Elizabeth
- Will contribute the code to the Marist cloud for use by future partners
Lasell College

- Marist is providing new Library functionality by hosting research tools needed by Lasell students and faculty

- Solutions are open source, Linux-based, and hosted
  - Provides Lasell a turnkey enhancement to existing Library service

- Marist learned about software that our Librarians are now considering for a Marist implementation

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Poughkeepsie Day School (PDS)

- PDS is a private K-12 that focuses on high-quality, personalized education for students

- Partnered with PDS to provide Sakai
  - Enhance the students’ experiences
  - Provide customized training on Sakai for teachers

- PDS is excited by the potential for international students to access content during breaks while in their home countries

- **PDS is a key feeder school and the College would like more of their students to apply**
Westchester Medical Center

- **Marist Services**
  - Provision course management (Sakai) and SIS
  - Provide course and professional development
  - Ensure quality content design and delivery through the collaboration of Marist faculty and Digital Education staff

- **Marist’s Allied Health programs will benefit from collaboration with the Medical Center**
Shared Ecosystem - Open Portlets

- Appointment Scheduling System
  - A web-based application
  - Students can make appointments with advisors or schedule tutoring sessions where students can select from a list of tutors
    - Advisors/tutors enter their availability at the beginning of each semester
    - Once a student makes an appointment, the advisor/tutor calendar is automatically updated

- Paywall System
  - A complete payment processing and shopping cart
    - Works with PayPal for payment processing and accepts direct credit card payment or payment from a PayPal account

- MMR Alerts
  - MMR portlet queries a function against Banner MMR data and returns a flag indicating whether or not a student is MMR compliant
    - The information returned is then used to present the student with a message on the student portal alerting them of their MMR compliance status

- All applets, portlets, and utilities written by Marist are open-sourced to the Community Cloud for anyone's use
Web Portal

- Design and Functionality Tools include
  - Pre-defined templates and structures
  - Multi-language support for 30+ languages
  - Rich text editor with spell check and text styling
  - Responsive design for mobile phones and tablets
  - Asset Publisher allows publication of content based on criteria such as author, tag, category and publish date
    - Will automatically aggregate content from all content types based on criteria entered
Enterprise Resource Planning (ERP) Components

- Accounts Receivable
- Advancement
- Advancement Self-Service
- Degree Works
- Document Storage
- Employee Self-Service
- Faculty & Advisor Self-Service
- Finance
- Finance Self-Service
- Financial Aid
- Financial Aid Self-Service
- Human Resources
- Position Control
- Student
- Student Self-Service
- Workflow
- Shared Ecosystem

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DegreeWorks Integration with Banner

- Ellucian delivers a Batch Data Extract Process
  - Banner data is required for DegreeWorks to generate a Degree Audit
    - Student data
    - Advisor information
    - Course catalog
    - Course equivalents from transfer institutions
  - Marists run this process nightly

- Ellucian also provides a Dynamic Data Extract for individual students
DegreeWorks 5.0.1 “Nuts and Bolts”

Web Servers: Java apps zSeries
LXDWWBXX 10.13.9.XX SLES12
LXDWWB03 10.13.9.64 SLES12

Application/Classic Servers: RedHat on Intel-based x86
LXDWXXX 10.13.8.XX SLES12
RabbitMQ
dwprod 10.10.5.xxx DW v5.0.1
LXDWTST3 10.13.8.29 SLES12
RabbitMQ
dwtest 10.10.5.122 DW v5.0.1

Database Servers: zSeries
LXDWPRMR 10.13.9.XX
DW production db
LXDWDBB2 10.13.9.67
DW test database

A10 device replaces proxy servers
Test system being developed

Note: RabbitMQ allows multiple classic Servers and load balancing.
Libraries and Digital Archives

- **Rockefeller Archive Center**
  - Web repository to support the ongoing acquisition, management, and preservation of digital records
  - “We are excited to partner with Marist College to develop and implement a digital records management system that will meet the needs of our archival staff, researchers, and donor organizations and that will be widely sharable with the broader archival community.”
    - Jack Meyers, President of the Rockefeller Archive Center

- **Lowell Thomas Archives Image Collection**
  - Digitized and created web repository of Marist Library’s Lowell Thomas Collection of photographs, audio recordings, and more

- **The Hudson River Valley Institute**
  - Academic Center Devoted to Education, Research, and Publication of Information on the Hudson River Valley, a National Heritage Area
Rockefeller Archive Center

- **Aurora**
  - Django web application
    - Receives, virus checks, and validates the transfer of digital archival records
    - Allows for appraisal and accession of records by archivists
  - Receives transfers when archivists push data to a jailed (isolated - locked down) account on a non-standard SSH port
    - A cron is run to process the transfers further in the application
Sakai Open Source Learning Management System

Open-Source Model

Community

Learning Management System

Apereo Foundation

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Why Sakai?

An LMS focused on Collaboration Capabilities

- The Sakai Community is a network of colleagues and experts
  - Share a common goal of enhancing the digital teaching and learning process

- Sakai evolves based on the changing needs of the Higher Education community

- Transparency within the community
  - Allows members to know what is happening at all times

- Collaboration opportunities are available through weekly phone meetings, on-site and virtual conferences, lightning talks, and more
Sakai Features

Management
- Overview
- Attendance
- Site Info
- Site Statistics & Analytics

Learning Materials
- Syllabus
- Lessons
- Resources

Communication
- Announcements
- Messages
- Forums
- Sign-up

Assessment
- Assignments
- Projects
- Tests & Quizzes
- Gradebook

Collaboration
- Forums
- Chat
- Student Pages
- Comments
- Peer Review
- Groups
- Project Sites
Shared Services Digital Education

- Provides “best-in-class” support to faculty and staff
  - Infuses Social, Mobile, Analytics, and Cloud (SMAC) into technology-facilitated pedagogical innovation
  - Enriches student learning experiences
  - Full lifecycle of professional development, course creation, delivery support, and communities of practice
Our Model

- Provide high-quality, engaging training on Sakai
- Engage through interactive workshops, interactive webinar sessions, or through collaborative online courses
- If you should need assistance in any part of the course development lifecycle, we will be available to assist
Open Academic Analytics Initiative

Deploying an Open Ecosystem for Learning Analytics
Petascale Analytics Processing Capabilities

**IBM – Netezza - The Preferred ETL Engine - Feeding Spark on IOP**
*(IBM Open Platform with Apache Hadoop)*

Learning Analytics Processor (LAP) Enhancements – Benchmarks
Sample data collected from July 30, 2007 through March 7, 2017 ~10 years

Are Students at Academic Risk?

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**ETL Extract Rates and Statistics From Events Table ~ 34 Million Rows (34,767,812)**

- Instructor and Student Tool Usage Counts
  - Instructor ~ 4.60 Million (4,683,361)
  - Student ~ 32 Million (32,855,592)

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**Benchmark Testing**

- Simple Counts (Seconds)
  - MySQL : 3.796
  - Netezza : 0.219
- Where Clause (Seconds)
  - MySQL : 9.3
  - Netezza : 0.234
- Like Clause (Seconds)
  - MySQL : 36.7
  - Netezza : 0.234

**Instructor Top 5 Tool Usage (Events)**
$250K Grant

OAAI Goal: Develop and deploy open-source Learning Analytics “early alert” system
- Designed to predict, within first 3 weeks, students “at risk” of not completing courses
- Uses open-source Sakai and Hadoop tools, as well as SPSS Modeler

Research agenda was focused on two primary areas
- Portability of predictive models – can models be designed to work in different academic settings
- Intervention strategies – what intervention strategies are most effective in improving outcomes

Model developed by Dr. Eitel Lauria, Professor and Graduate Director, Information Technology & Systems, Marist College School of Computer Science and Mathematics
OAAI Early Alert System Overview

Student Aptitude Data
(SATs, current GPA, etc.)

Student Demographic Data
(Age, gender, etc.)

Sakai Event Log Data

Sakai Gradebook Data

Predictive Model Scoring
Model Developed Using Historical Data

Academic Alert Report (AAR)
Identifies students “at risk” to not complete course

Intervention Deployed
“Awareness” or Online Academic Support Environment (OASE)

“Creating an Open Academic Early Alert System”
Academic Analytics Visualization
Deans’ Dashboard Capabilities

Institutional Tool Usage By Students
Semester: 16S

Departmental Tool Usage By Instructors
Semester: 16F

Deans’ Dashboard of Saturation of Tool Usage
Deans’ Dashboard Capabilities (continued)

Risk Probability
Deans’ Dashboard Capabilities (continued)

Risk Probability Stacked Bar Chart
Learning Analytics Faculty Dashboard

- Provided through CMS
  - Developed using Apereo’s open source OpenDashboard
  - Marist customizations and enhancements were contributed back to the educational community
  - Leverages current Netezza data warehouse capability
  - Uses next generation Learning Analytics Processor (LAP)

Faculty View

Individual Student View
Predictors used to train, test, and score (predict)

- Online Flag
- Enrollment
- Aptitude Score
- Age
- Gender
- Enrollment Status
- Class
- Cumulative GPA (not including current semester)
- Academic Standing
Benefits of the Shared Service Model

- Hardware and other capital costs disappear
- Staffing costs are reduced
- Licensing costs are reduced
- Time to benefit is increased
- Access to advanced technologies
- Redundancy, upgrades, and back-ups provided
- Self-interest takes precedence over vendor plan
- Work with ‘like-missioned’ organizations
Benefits of the Shared Service Model (continued)

Virtuous Cycle

MARIST

Marist Innovations Developed

Marist Production Environment

Product and Services Development Cycle

Cloud University Production Environment

Cloud University Innovations Developed
Benefits of the Shared Service Model (continued)

- Guidance and Support Services
  - A community of consultancies, shared resources, and best practices
    - Peer-based Learning
    - Consulting
    - Industry Resources / Resource Enhancement
    - Collaboration
    - Support Network
    - Mentorship
Open Discussion / Questions