

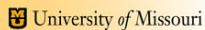
# App Chaining for an Advanced Manufacturing Marketplace

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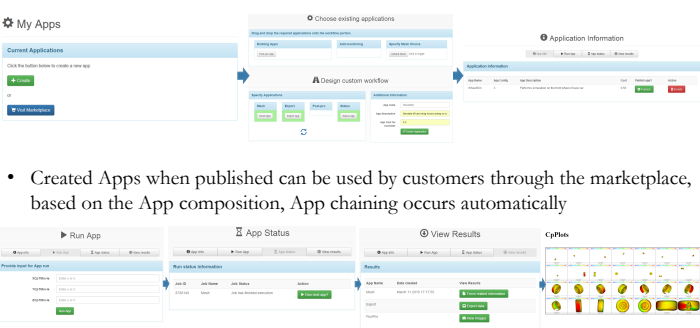
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## Advanced Manufacturing and Cloud Computing

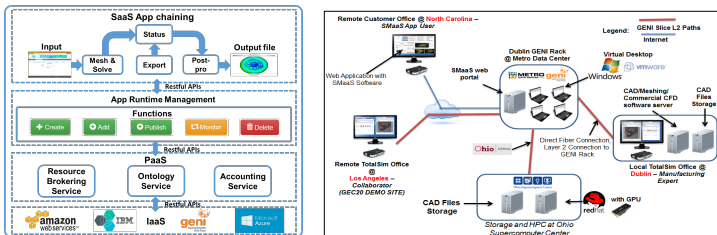
- Advanced manufacturing design today requires iterative/collaborative work among multi-site engineering experts in e.g., fluid/thermal analyses
- Need to enable small businesses to easily adopt cloud-based architectures for their workflows with data-intensive computation and networking
- Our App Marketplace fosters multiple Apps to communicate and ensure mutual gain in an App Marketplace
  - Compatible with hosting with any cloud-platform and tie-in with their accounting/billing services
  - Faster design and quicker revenue generation for advanced manufacturing community!
- First step towards developing an App Runtime environment in GENI to foster organic growth of an App marketplace, where multiple manufacturing companies can leverage cloud technologies
- GENI Relevance:** TotalSim, in collaboration with MU is using GENI for PaaS and Cloud networking experiments to study how they can deliver their Apps to their customers with *lower design time and cost/simulation*

## App creation & usage workflows

- Unique workflows can be generated and chained for the core applications with custom geometries based on requirements of manufacturing enterprises
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- Created Apps when published can be used by customers through the marketplace, based on the App composition, App chaining occurs automatically
  - Unique outputs from each App are provided as inputs to the next App in the chain
  - Chained App Workflows enable faster delivery of innovative products to market!

## Advanced Manufacturing App Marketplace

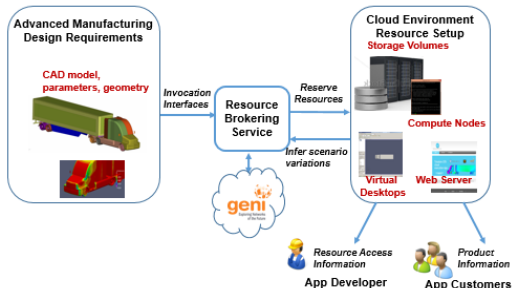
- The hybrid cloud architecture of the App marketplace uses GENI infrastructure and Ohio Supercomputer Center to facilitate 'agile manufacturing'
- Manufacturers deliver complex designs to customers using workflow integration services that chain unique Apps which communicate with each other



### App Marketplace Architecture

### App Marketplace Dev & Hosting Environment

- Our environment uses GENI to provision resources to both App developer and App customers based on the individual requirements

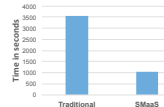
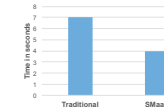


## Use Private Cloud or Public Cloud?

Private Cloud	Public cloud
Interaction with Personnel	Interaction with APIs
Order based queuing systems	On-demand usage i.e. no waiting
Hardware upgrades minimal	Latest hardware used
Limited scaling capabilities	Unlimited scaling potential
<b>Cost for a simulation : \$0.87</b>	<b>Cost for a simulation : \$5.04</b>

Note: Cost models considered are for Ohio Supercomputer Center and AWS

## Conclusions

- Access to a remote model from GENI cloud is 3x time faster than traditional approach
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- Model observation and rotation from the GENI rack is smooth during interaction and has no user-perceivable lags
- 
- Using GENI technologies for App Marketplace greatly reduces access times and results in better experience for the Users and facilitates Agile development

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