State of the Healthcare API Economy

An Innovation Forum Session

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Conflict of Interest

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Has no real or apparent conflicts of interest to report.
Learning Objectives

• Discuss the value of open APIs and networks and review the opportunities and challenges represented by them

• Explore need to build future API touch-points that can allow tighter workflow integration and a more open ecosystem of applications

• Identify sustainable approaches and examine a maturity model with essential, nice to have, and future need capabilities to nurture and scale API-led innovation

• Describe critical issues facing health innovation developers and identify ways to foster a thriving ecosystem of partners
Acknowledgements

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VCU Health
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Xealth
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APIs are the future of healthcare.
Forbes

2017 Is Quickly Becoming The Year Of The API Economy

Louis Columbus Contributor ☺
Application Programming Interface
business models
+ 
business channels
+ 
secure access 
×
exchange of data
= 
API Economy
Our world has changed.
The world has changed. Healthcare deserves better.
WELCOME
APIs are the latest in a long road to healthcare interoperability

**HL7 v1 (1987) and HL7 v2 (1988)**
- Messaging formats containing patient information and designed for machine processing
- Flexible and varies by use case, e.g. SIU (scheduling), ADT (Admit/Discharge/Transfer)

**HL7 CDA (2005)**
- Document standard for HL7 v3 designed to output patient encounter data in a “user-readable” format (has both XML and HTML components)
- Flexibility spawned many sub standards (e.g. the C32 constraint for Meaningful Use Stage 1)

**HL7 FHIR (2011+)**
- Defines “resources” (e.g. allergy info) and APIs to access them
- Resources can be bundled into documents/messages
- Logically compatible with HL7 v2 and C-CDAs
- Enables app integration using SMART on FHIR standard

**API Standards: robust information exchange for many purposes**
Build on Web technology, security, communities

- **1987**: First meeting of HL7
- **1987**: Office of the National Coordinator (ONC) created
- **1990**: HL7 v1 (1987) created
- **1990**: HL7 v2 (1988) created
- **2000**: HL7 CDA (2005) created
- **2004**: Office of the National Coordinator (ONC) created
- **2005**: HITECH Act passed
- **2010**: MU Stage 1
- **2012**: MU Stage 2
- **2018**: MU Stage 3 mandatory for all providers
- **2020**: HL7 FHIR (2011+)
APIs drive costs down

- Stable / robust information handling techniques
- Wide availability of developers, Libraries
- Deep debugging / testing frameworks
- Re-use existing security approaches and arrangements
- Proven solid methods of developing communities

But... Health is still hard!
Entrenchment has historically required time, critical mass, and gov’t involvement

1997: Physician group drafts CDA standard

2000: HL7 publishes CDA Release 1

2005: HL7 publishes CDA normative release

2010: MU1 includes CDA formats among those allowable for clinical care summaries

2011: ONC, HL7 create the C-CDA as single standard for care summaries

2012: MU2 proposal requires solely C-CDA for summary of care records

2012-2014: athenahealth, Epic, other EHRs adopt C-CDAs to meet MU2

2014: MU2 reporting period begins; criticism mounts on C-CDA inconsistency; first FHIR version released
Entrenchment has historically required time, critical mass, and gov’t involvement

New Adoption / Mindshare

FHIR

2011: First proposal for FHIR standard

2014: HL7 publishes FHIR DSTU 1 (Q3); Argonaut Project begins (Q4)

2015: FHIR DTSU 2 published; EHRs show support with FHIR dev tools at HIMSS

2016: Major consumer brands rally around FHIR through CARIN Alliance

2017: FHIR DTSU 3 published with 30+ core endpoints mature enough for use

2018 Q1: MU3 requires availability of clinical data via open APIs; Apple Health integrations go live
How available would you say the FHIR standard is these days?

Available for Read, Write, Update: 8%
Available for Read: 34%
Not Widely Available: 45%
Not Sure: 13%

Total Responses: 54

FHIR Goals were always economic

- Interoperability is about **economics** (cost shifting)
- Develop a general purpose healthcare API standard
- Use PHR as an exemplar for economic impact
  - TCO for Personal Health Repository: $150k is not a sustainable cost
  - Develop PHR specification (Argonaut)
  - Goal: 90% reduction in TCO - probably achieved
Applications of open APIs and FHIR

**Personal Health Managers**
- Apps that pull in clinical data from EHRs, health apps, and medical devices/wearables (e.g. Apple Health)

**Application Extensibility**
- Patient- or provider-facing apps that access clinical data to/from an EHRs & provide new services

**Health Care Process Improvements**
- Integration of new workflows between provider and payor
- Seamless transitions of care on an ongoing basis

**Data Analytics & Reporting**
- Granular access to clinical data across EHRs (e.g. for pop. health, payers)
- Easily building Clinical Data Repositories

**FHIR Based Applications**
- Build entire applications from scratch using FHIR as internal API
FHIR has all the characteristics of a next-generation standard

Positives
• Access to relevant, granular data vs. large, redundant flat files
• Mobile-friendly
• Standard access to data elements across EHRs
• Uses familiar web standards (XML, JSON, HTTP, SSL, OAuth 2.0)
• Internal standardization for multiple products/workflows
• Backwards compatible (e.g. FHIR resources can be compiled into C-CDAs)
• Open source libraries (e.g. HAPI-FHIR, SMART on FHIR)

Negatives
• Standardization is not yet complete
• FHIR adoption still low and standard not fully mature
Limits of FHIR

• HL7 standardizes exchanges
  ○ ~1000 vendors understand how standards work
  ○ Highly configurable systems - limit what can be standardized

• The dream: fully standardized content
  ○ Requires consistent configuration, work practices
  ○ ~100,000k care providers, no(?) interest in standards
CDS Hooks aims to give external services a way to plug into the EHR
Consumer-driven exchange may expedite adoption of a shared standard

**Consumer Access**
Mobile health apps that send data to EHRs/clinical research, such as Apple Health and Sync for Science

- **Apple Health** uses FHIR to import clinical data from EHRs of select providers

- **iBlueButton** uses Direct on FHIR to access health data through government payers

- **WebMD Health Manager** (and related apps) access a patient’s clinical data through an employer in C-CDA format

**Consumer Initiated Exchange**

Consumers also drive interoperability through:

- **Consumer-directed exchange** (CDEx) of clinical data between EHRs at a patient’s request

- **Personal health records** (PHRs) like Apple Health, Microsoft HealthVault, and Google Fit aggregate data from fitness, diet, and disease management apps (and now vying for EHR data as well)
“We share the common quest to unlock the potential in healthcare data, to deliver better outcomes at lower costs. **Open standards, open specifications, and open source tools are essential to facilitate frictionless data exchange.** This requires a variety of technical strategies and ongoing collaboration for the industry to converge and **embrace emerging standards for healthcare data interoperability, such as HL7 FHIR and the Argonaut Project.**”

Large consumer brands are becoming a driving force behind FHIR

<table>
<thead>
<tr>
<th>Brand</th>
<th>Initiatives</th>
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</table>
| Apple      | FHIR implementation in Apple Health as part of iOS 11.3  
Member of Argonaut Project and CARIN Alliance                                           |
| Google     | Google Cloud for Healthcare includes Cloud Healthcare API for developers; supports FHIR  
Provides API layers for health system data via Apigee; supports FHIR  
Partnered with HL7 FHIR Foundation and member of CARIN Alliance                            |
| Microsoft  | Published HL7 FHIR on Azure guide for implementation of FHIR-based servers  
Ongoing project creating a FHIR library for Microsoft HealthVault mobile app                   |
| 23andMe    | Subject of proof of concept using FHIR for reading/writing genomics data to/from EHRs  
Member of CARIN Alliance                                                                       |
| Verizon    | Member of CARIN Alliance advocating secure PHI transfer using FHIR and OAUTH 2.0                                                             |
| IBM        | IBM Watson Platform for Health supports access and analysis of data via FHIR endpoints  
Member of HL7 Partners in Interoperability & HL7 FHIR Applications Roundtable                 |
So where are we now?
CMS EHR Incentive Program: Meaningful Use Stage 3 (MU3)

“Any application chosen by a patient would enable the patient to gain access to their individual health information provided that the application is configured to meet the technical specifications of the API.

Providers may not prohibit patients from using any application, including third-party applications, which meet the technical specifications of the API, including the security requirements of the API.”

– Center for Medicare & Medicaid Services, “Medicaid EHR Incentive Program Stage 3 - Patient Electronic Access to Health Information”

Note: For 2019 and beyond, “MU3 – Patient Electronic Access to Health Information” becomes “Promoting Interoperability Programs – Provider to Patient Exchange”

21st Century Cures Act: Trusted Exchange Framework (TEFCA)

• Proposes nationwide HIE to be managed by a single Recognized Coordinating Entity (RCE)
  – Participation is voluntary
  – RCE to be chosen via competitive bidding, must have history of “multi-stakeholder collaborations and implementing governing principles”
  – RCE will add provisions and technical requirements (with ONC approval) to cover unaddressed policies

• TEFCA requires qualified entities (i.e. EHRs) to:
  – …use a MPI, record locator, and query service
  – …be participant neutral (not withhold data)
  – …meet standard core data classes

• Recommends use of ISA standards: C-CDA, HL7 v2 messaging, FHIR

• Data Blocking – New rules Proposed this week!

Seeing the EHR as a platform.
Leading EHRs have all enabled some API integration (including FHIR)...

• 15+ FHIR resources (DTSU2); proprietary APIs for other use cases
• App integrations available through Allscripts Developer Program, including SMART on FHIR
• API docs and sandbox publicly available through Allscripts Developer Program: developer.allscripts.com

• 20+ FHIR resources (DTSU2); proprietary APIs for other use cases including pop. health
• App integrations available through MDP, including SMART on FHIR
• Member of the HL7 Argonaut Project; FHIR integration with Apple Health
• API docs and sandbox publicly available on athenahealth Developer Portal: developer.athenahealth.com

• 25+ FHIR resources; proprietary APIs for other use cases including pop. health
• All new app integrations through SMART on FHIR (legacy apps may still use proprietary APIs)
• Member of the HL7 Argonaut Project; FHIR integration with Apple Health
• API docs and sandbox publicly available on Cerner | CODE: code.cerner.com

• 20+ FHIR resources (DTSU2); proprietary APIs for other use cases
• App integrations available through App Orchard, including SMART on FHIR
• Member of the HL7 Argonaut Project; FHIR integration with Apple Health
• API docs and sandbox publicly available on open.epic: open.epic.com
In general, the big 4’s APIs are getting better

- High technical quality, relatively easy to work with
- Not great, but workable
- Poorly designed APIs

Rise of the app stores of the EHRs
Big 4 becoming much better partners

- **Allscripts**
  - Program exists; easy to understand: 2018 - 63%, 2018 - 72%
  - Program exists; enrolling somewhat complicated: 2018 - 27%
  - Non-existent programs; difficult to enroll: 2018 - 10%, 2018 - 3%

- **athenahealth**
  - Program exists; easy to understand: 2018 - 72%, 2018 - 3%
  - Program exists; enrolling somewhat complicated: 2018 - 25%
  - Non-existent programs; difficult to enroll: 2018 - 3%

- **Cerner**
  - Program exists; easy to understand: 2018 - 38%, 2018 - 38%
  - Program exists; enrolling somewhat complicated: 2018 - 23%
  - Non-existent programs; difficult to enroll: 2018 - 23%

- **Epic**
  - Program exists; easy to understand: 2018 - 60%
  - Program exists; enrolling somewhat complicated: 2018 - 23%
  - Non-existent programs; difficult to enroll: 2018 - 17%

App stores enable a nascent ecosystem for apps using these APIs

- Allscripts Developer Program: 110 apps
- Cerner code: 28 apps
- Athenahealth marketplace: 225 apps
- Epic App Orchard: 117 apps
Relative availability of apps by use case

- Education or Training
- Decision Support
- Eligibility
- Inter-organizational Workflow
- Data Management
- Notifications
- Clinician-Patient Communications
- Clinician-Clinician Communications
- Scheduling
- Clinical Quality Management
- Referrals or Consults
- Utilization Management
- Device Management
- Claims Management
- Prior Authorization
- Denials Management

Across care venues, hospitals and physician offices have the most app representation

### Relative Availability of Apps in Hospital Venues

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>Acute Care</td>
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<tr>
<td>Surgical</td>
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<tr>
<td>ED</td>
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<tr>
<td>Ambulatory</td>
</tr>
<tr>
<td>Critical Care</td>
</tr>
<tr>
<td>Pharmacy</td>
</tr>
<tr>
<td>Admission Discharge</td>
</tr>
<tr>
<td>Billing</td>
</tr>
<tr>
<td>Radiology</td>
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<tr>
<td>Medical Records</td>
</tr>
<tr>
<td>EMS</td>
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<tr>
<td>Lab</td>
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</table>

### Relative Availability of Apps in Community Venues

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>Specialty Care</td>
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<tr>
<td>Primary Care</td>
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<tr>
<td>Ambulatory Surgical Center</td>
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<tr>
<td>Urgent Care</td>
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<tr>
<td>Billing and Office</td>
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<tr>
<td>SNF</td>
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<tr>
<td>Imaging Center</td>
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<tr>
<td>Pharmacies</td>
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<tr>
<td>Home Health</td>
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<tr>
<td>Payer</td>
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<tr>
<td>Infusion Center</td>
</tr>
<tr>
<td>Reference Lab</td>
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</tbody>
</table>

225+ apps and services
65+ apps in SMART App Gallery

SMART on FHIR: Application Categories

Patient Engagement: 30
data Visualization: 25
care Coordination: 23
Risk Calculation: 19
Population Health: 17
Medication: 16
Clinical Research: 12
Genomics: 6

Benefits of app stores

- Eliminate RFP process
- Cut down integration costs and implementation time
- Filter signal from noise – glean from peer reviews and best practices
- Agile pilots – try before you buy
- Lower investment and risk
- Shopping experience – choice of similar functionality within category
Hurdles on the track to substitutable apps

- Thousands of software developers need more confidence to invest in this technology
- Physicians need to “remember” to launch an app at the right point during a workflow
- Apps are more focused on read than write
- There is variation in business rules for connecting apps
- There is variation in API implementations

Use of 3rd party integrators growing

Data access method, the big 4 compared in 2018

- **Allscripts**
  - Accessed Vendor API: 14%
  - Used 3rd Party Integration Engine: 4%
  - Used Batch or Non-API Data Exchange: 72%
  - Used Direct or Other Protocol: 83%

- **Athenahealth**
  - Accessed Vendor API: 14%
  - Used 3rd Party Integration Engine: 10%
  - Used Batch or Non-API Data Exchange: 4%
  - Used Direct or Other Protocol: 83%

- **Cerner**
  - Accessed Vendor API: 14%
  - Used 3rd Party Integration Engine: 25%
  - Used Batch or Non-API Data Exchange: 39%
  - Used Direct or Other Protocol: 40%

- **Epic**
  - Accessed Vendor API: 6%
  - Used 3rd Party Integration Engine: 26%
  - Used Batch or Non-API Data Exchange: 29%
  - Used Direct or Other Protocol: 40%

Rise of the “API Connectors”
Providers and the API economy
OUR ROOTS DATE BACK TO A HUMBLE BEGINNING.

In 1940, we opened our doors as Charlotte Memorial Hospital.

Over the years, our mission to care for all has remained the same.

But our reach, our scope and even our name have changed.
Atrium Health

- Headquartered in Charlotte, North Carolina
- 50+ hospitals in North Carolina, South Carolina and Georgia
- 8 Nationally Ranked Clinical Programs
- 3,000+ physicians
- 16,000+ nurses
- 65,000+ teammates
- 7th largest Medical Group in the U.S.
- 12 million patient interactions each year
- $2.03 billion each year in uncompensated care and other community benefits
A place filled with light.
Where each and every heartbeat begins.
Where connections are made –
Bringing health, hope and healing for all.
HEALTH
HOPE
HEALING
FOR ALL
innovation

done
right

makes
technology
invisible
Are providers a barrier?
Providers may be the biggest hurdle

<table>
<thead>
<tr>
<th>Question</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Do you, as a startup, have: provider clients / prospects who have</td>
<td>13%</td>
</tr>
<tr>
<td>already made data available via FHIR?</td>
<td></td>
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<tr>
<td>Do you, as a startup, find your provider clients have:</td>
<td>22%</td>
</tr>
<tr>
<td>little interest in this?</td>
<td></td>
</tr>
<tr>
<td>no experience with this?</td>
<td>33%</td>
</tr>
<tr>
<td>Total respondents: 54</td>
<td></td>
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Why should providers do this?

Modern software development and deployment ideas are knocking on HCO doors

- Cloud deployment, agile development, social/mobile, microservices, REST/JSON, NoSQL databases have changed IT
- APIs are revenue source for many companies in many industries

New models of care need:

- Broader distribution of clinical expertise
- Delivery in lower cost venues and in different channels

Opportunities to reduce inefficiencies

- Reusable clinical alerts, quality metrics
- New approaches to care coordination
As providers, payers, and patients react to these forces, data and analytics become a daily need of most medical practices.
Disruptors are focused on using data and analytics as a key advantage as they respond to these trends.

Disruptive Care Delivery Organizations

Provider Services

Payer Services

Platform First Organizations
Open data models will help you to...

- Foster a culture of innovation
- Be flexible in vendor choice
- Respond with agility to market demands
- Give up some of your Legos

Are you actively utilizing/working on utilizing APIs in any of your applications?

- 57.1% No APIs
- 42.9% Thinking about utilizing APIs
- Actively working on utilizing APIs
- Have APIs live in production
Is the demand and usage of API-based apps being driven mainly by patients or clinicians?

What are your pioneer API-based applications?

• We have several in the works, including integration with Amazon’s Alexa.
• Apple Health, Video Visit
• Apps, claims, health insurance
• Apple Health / Visual Dx / a Cerner developed one for heart risk
• Find a Doc, JeffDocs, myJeffHealth, and more internal apps. Epic, ECW, AllScripts, Cerner, etc. as external apps.
• all epic related. IoT
• Medical Year in Review
For any work you’re doing on APIs, is this:

- In-house development: 85.7%
- 3rd party: 71.4%
- Out of the box: 57.1%
Who is paying for apps and what cost considerations (if any) are driving your efforts?

| The business models are still being worked out. Definitely an area of focus. |
| Health system |
| The health system |
| Using the free ones currently |
| We have our own budget and cost has so far not been an issue as we do a lot of internal development at lower cost. |
| our organization |
| ACOs |
Which of your existing data sources will be most valuable for API-driven applications?

- Freeing the clinical data and allowing patients to actively engage and interact.
- EMR’s and Data Warehouse
- Research
- EMR (Millenium)
- EMRs, Data Warehouse, Clinical Intelligence Systems, ERP, Supply Chain, IoT systems, Building Automation Systems, Messaging Systems, Workflow Systems, BPM tools, etc.
- all things clinical
- Claims and Clinical
**What role does your IT department play with API-based applications? What are some essential skill sets and processes to build into the IT department?**

IT helps manage day to day operations, which is critical. Would be great to have IT interact more with developers and the startup ecosystem.

Define the API design patterns, security, monitoring, Mobile developers

We build and get it approved

We don't possess yet

The Digital Group I founded does most of the API-based application work and development. You need software developers, data scientists, and designers.

drivers of API. Previous API experience helpful. We leverage Agile for DevOps

IT maintains the API server.
Do you have specific governance around APIs? Please explain your model.

This is an area of opportunity. Currently, governance around APIs is tied to overall governance around access to data and resources within the org.

Enterprise Architecture team - Facilitates the Architecture Review Board

Yes cybersecurity and value for the institution

We don't - but models I've seen presented previously were similar to how a P&T committee does its work (ie - show us the evidence, cost, etc. etc.) I could probably dig up the presentation - it was given at AMDIS 2 or 3 years ago

Yes. We have data governance around APIs.

Follow Agile and ITSM processes but fairly open

Yes. Governance is needed to ensure that as APIs evolve they do not impacting other applications
What’s the one thing you’d want your EMR vendor to do more of around APIs?

- Make available more FHIR based resources with dev toolkits etc.
- Support Bulk Access to data vs. 1:1
- FHIR server at least first 30 resources read and write
- Go faster, make the tie ins on their end infinitely faster
- Actually create useful aggregated conduits.
- Increased openness. Not limited to what they are comfortable with but all the data sources we require
- Expose more of the patient record
Can open APIs and an app-based ecosystem accelerate your organization's response to changing market dynamics?

Yes

100%

Absolutely

God, please yes

Yes, this is our strategy

For sure
## Provider action items

<table>
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<th>Action Item</th>
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<tbody>
<tr>
<td>Press EHR vendors – “Coalition of the willing”</td>
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<tr>
<td>Upgrade your EHR and integration technology platforms to versions that support FHIR</td>
</tr>
<tr>
<td>Begin API governance discussions</td>
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<tr>
<td>Concentrate on EHR UX issues before functional enhancements</td>
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<tr>
<td>Plan your first FHIR projects based on vendor and staff readiness</td>
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<tr>
<td>Encourage your integration and technology teams to experiment with the technologies underlying FHIR, including JSON and RESTful APIs</td>
</tr>
<tr>
<td>Educate key interface and application development staff on FHIR essentials</td>
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</tbody>
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AND THE DAY CAME
WHEN THE RISK TO
REMAIN TIGHT IN A BUD
WAS MORE PAINFUL
THAN THE RISK IT TOOK TO
BLOSSOM

- ANAIS NIN
Q&A and Contact Information

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