Cisco Systems Smart Analytics

Jarrett Fishpaw, Business Operations Manager

Tyler Munger, CITRIS Intern

UC Santa Cruz, ISM 101: Thursday, February 16, 2012
Agenda

• Jarrett’s Personal Background
• Cisco Systems Overview
• What is Cisco Services
• Cisco Services Technology Group
• Smart Analytics – ‘Actionable Insight’™
• Day in the life of a Cisco Employee
Jarrett Fishpaw

• B.A. Business Management Economics (2009)
• Business Operations Manager, Cisco Systems
  Contractor from June 2010 - April 2011
  FTE since May 2011

Job Role:

• 50% - Incubation and Innovation of new analytical models
  Software Quality – Benchmarking, Modeling and Prediction

• 50% - Specific projects
  Network Analytics Interface 3.0
  Network Performance Analytics 1.5
  Smart Analytics 2.0
Cisco Systems

• At Cisco (NASDAQ: CSCO) customers come first and an integral part of our DNA is creating long-lasting customer partnerships and working with them to identify their needs and provide solutions that support their success.

• Husband and wife Len Bosack and Sandy Lerner, both working for Stanford University, wanted to email each other from their respective offices located in different buildings but were unable to due to technological shortcomings.

• A technology had to be invented to deal with disparate local area protocols; and as a result of solving their challenge - the multi-protocol router was born.

  Len Bosack, Sandy Lerner, Richard Troiano, Nicholas Pham
**Strong Geographical Balance**

<table>
<thead>
<tr>
<th>Region</th>
<th>Revenue</th>
<th>Y/Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americas</td>
<td>$6.6B</td>
<td>4%</td>
</tr>
<tr>
<td>EMEA</td>
<td>$2.9B</td>
<td>2%</td>
</tr>
<tr>
<td>APJC</td>
<td>$1.8B</td>
<td>11%</td>
</tr>
</tbody>
</table>

Total $11.3B 5% Y/Y

Q1 FY12 Fiscal Revenue by Geography
### Market Share Leadership

<table>
<thead>
<tr>
<th>Category</th>
<th>Vendor 1</th>
<th>Vendor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
<td>32%</td>
<td>62%</td>
</tr>
<tr>
<td>Digital Video: IPTV</td>
<td>62%</td>
<td>70%</td>
</tr>
<tr>
<td>Voice</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>Wireless: LAN</td>
<td>56%</td>
<td></td>
</tr>
<tr>
<td>Routing: Edge/Core/Access</td>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>Networked Home</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Storage: Area Networks</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>Web Conferencing</td>
<td>49%</td>
<td></td>
</tr>
</tbody>
</table>

© 2010 Cisco and/or its affiliates. All rights reserved.
culture
employees

...are our competitive advantage

63K+ employees
165+ countries
470+ offices

1/3 sales
1/3 engineering
1/6 service
1/6 other
Cisco Services

- Employees Worldwide: 11,400+
- Certified Professionals: CCIE= 2,000+
- Patents ~700 since 1998
- Cisco Partners
  - Services is responsible for 80% of the revenue coming from Cisco Partners
  - There are over 280,000 partner employees which provide channel leverage
  - Over 68,000 authorized/registered partners
  - Provide support in over 180 countries worldwide
CSTG at a Glance

• The Cisco Services Technology Group drives technology innovation and software development to accelerate the evolution of our Advanced and Technical services portfolio.

• Our global organization consists of five primary groups:
  Technology Development
  Support
  Business Operations
  Globalization
  Expertise

• We are accountable for developing, delivering, and supporting the technologies Cisco Services deploys in our markets.
Analysts

IBM opens a Services Innovation Lab (SIL)…the lab will accelerate the expansion of real-time analytics … in both IBM’s technology services offerings and its global services delivery capabilities. (4/2011)

IBM has committed $2 billion in service R&D

Competitors

Smart Analytics represent an excellent delivery of intellectual capital…This type of IC scored in the top 3 of partner demands in the partner focus groups regarding …desirable service elements  
- Market Intelligence Team, 5/2011

IT complexity will soon outstrip customer’s IT management capabilities – Forrestor

Network managers have more information than ever … Making sense of the information is the essential challenge… trends will see the effective transition of development priorities from network technology to IT analytics  
- IDC, 3/2011

Role of Analytics in Complex Networks
Cisco Smart Analytics (SA)

- Understand network health
- Set and measure progress against network improvement plans and change initiatives
- Compare against peers in the same vertical on certain metrics such as technology maturity and operational maturity
Data

• Big Data requires:
  Hadoop
  SAS
  R
  Denodo

• Domain Experts Collaborating with Statisticians

• ‘Big Data’ combined with Analytics
Analytics

Process data using advanced tools, and domain expertise

Techniques:

Data Clustering
Data Mining
Correlation Analysis
Time Series - ARIMA Models
Predictive Forecast
Multivariate Regressions
Cross Sectional Data
Historic Trending

Linear Regression

$$y = X\beta + \varepsilon,$$

Multivariate Regressions

$$y_1 = \beta_1 x_1 + \epsilon_1,$$
$$y_c = \beta_c x_c + \epsilon_c,$$
$$y_m = \beta_m x_m + \epsilon_m,$$

ARIMA – Autoregressive Integrated Moving Average

$$\left(1 - \sum_{i=1}^{p} \alpha_i L^i\right) X_t = \left(1 + \sum_{i=1}^{q} \theta_i L^i\right) \varepsilon_t$$
Differentiated Cisco Services

Delivery of Intuitive Insight

- Industry Benchmarking
- Root Cause Analysis
- Predictive Forecasting
- ROI Simulation
- Visualization
Tyler Munger

- CITRIS Internship

Project:
- Failure Modes Analysis
Customer-facing Cisco TAC teams receive thousands of service requests (SRs) every month on a wide variety of networking products, e.g. Adaptive Security Appliances (ASA)

These SRs reside in the Topic/C3 database and contain valuable information about product issues experienced by customers

Data mining Topic/C3 for product issues will enable:

1. Extraction of key product failure modes
2. Time signatures for failure modes

One of the missions of the Smart SAVI group to develop automated data mining analytics software tools for use by the TAC teams
Problem Description

• For a given customer service request, identify the associated failure mode

• For a particular failure mode determine its daily frequency of occurrence across all customers

• Challenges:
  - Ambiguous free form text
  - Highly technical domain knowledge
  - Multifaceted customer problems
Example: ASA 5505 Failover

• An important feature of the ASA 5505 network security product is failover. The failover feature allows for high availability configurations where a redundant backup device automatically takes over in the case of a failure.

• What are the dominant failure modes for failover and the associated time signatures, based on data mining customer service requests?

“We have one ASA with 2 ISP connections and several site to site VPN’s set-up to other sites with ASAs. When we test failing over the VPN’s to use the second ISP connection the tunnels are not coming up. We have confirmed that outbound routing fails over immediately.”

Typical Customer Problem Description for the ASA
Approach: Product Development, Data Mining, and Software Engineering

1. Work with subject matter experts to develop a failure mode taxonomy for the failover feature on the ASA 5505 product
2. Collect a dataset of service requests for the ASA 5505
3. Construct a software environment for data mining service requests to determine failure modes
4. Evaluate several classification algorithms on the training/test dataset
5. Use the best classifier to automatically label the full dataset with the corresponding failure modes
The Support Vector Machine classifier was the most accurate for relevance (99%) and failure mode detection (72%).

The Support Vector Machine classifier was then used to automatically identify the ASA 5505 failover related SRs in the dataset and label them according to failure mode.

Dominant failure modes were “failover communication between devices”, “VPN tunnels disconnected after switchover”, “configuration not in sync after switchover”.

<table>
<thead>
<tr>
<th>Failure Mode</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failover communication between devices</td>
<td>1414</td>
</tr>
<tr>
<td>VPN tunnels disconnected after switchover</td>
<td>922</td>
</tr>
<tr>
<td>Configurations not in sync after switchover</td>
<td>609</td>
</tr>
<tr>
<td>No switchover</td>
<td>450</td>
</tr>
<tr>
<td>Hardware</td>
<td>224</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F Measure (Accuracy)</th>
<th>Bayesian</th>
<th>Support Vector Machine</th>
<th>Decision Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>0.984</td>
<td>0.996</td>
<td>0.992</td>
</tr>
<tr>
<td>Failure Mode</td>
<td>0.679</td>
<td>0.723</td>
<td>0.712</td>
</tr>
</tbody>
</table>
Results-2: Failure Mode Time Signature

- Time series analysis was used to create a time signature for each failure mode
Next Steps

• The data mining results also included a large (~10,000 SRs) miscellaneous category that contained potentially important failure modes that have not been explicitly identified by the subject matter experts.

• Further work with the subject matter experts using the Product Development techniques (FS, FAST, FMEA) is necessary to determine these important failure modes and improve the robustness of the data mining.

• Develop an automated software tool to allow TAC to monitor failure modes for selected products in the Topic/Case Kwery environment.
What is it like to work for Cisco?
Day in the Life of a Cisco Employee

- Many employees have a unique and flexible work schedule
- WebEx Meetings
- Outlook Calendar
Day in the Life of a Cisco Employee

- Each manager has a different style
- Responsiveness to Email and IM’s (Phone/text occasionally)
- Personal discipline to manage multiple projects simultaneously
Do you know Cisco?

Cisco Business questions

• What year was Cisco Founded?
• How large is Cisco (people/revenue)?
• How many authorized partners does Cisco have?
• Cisco Support is available in how many countries worldwide?

Cisco Certification questions

• Name 2 Cisco networking certifications
• Name a ‘Certification Path’ for Cisco CCIE certifications