G2S: Why a Standard Protocol Really is Better

Russ Ristine – Radical Blue Gaming
Agenda for this session:

- What is G2S? (a little history)
- The Benefits of G2S
- Securing the New Environment
- Case Study – The Road to Aria
A Quick History of G2S

How did we get here?
First we had SAS

- SAS became the de-facto standard over the last 25 years
- Requires a SMIB in the EGM
  - Player peripherals connect to the SMIB
  - SMIB connects to system via proprietary protocol
- Polled Serial protocol – 19,200 bps
  - No way to push content to the EGM
- Server-based gaming is not possible with SAS
What is GSA / G2S?

- GSA = Gaming Standards Association
  - EGM and System Manufacturers
  - Operators
  - Test Labs and Regulators

- Goal – create three standard protocols
  - GDS ↔ G2S ↔ S2S

- G2S = Game to System Protocol
  - Developed by GSA members (all could contribute)
  - Extensible so manufacturers can add “Secret Sauce”
WHY is G2S Cool?

1. Every EGM can talk directly to multiple hosts
2. Uses off-the-shelf Internet technologies
3. Host can access incredible data in each EGM
4. Since G2S accommodates multiple hosts
   ▶ The slot system does the regulated apps, allowing new applications to flourish
Here’s HOW your floor works now
With G2S, there’s a network on your floor!

Slot Floor System
Player Analysis
Marketing
Bonusing
The Benefits of the Network

- Fast – 50,000 times faster than SAS
- Uses standard Internet technologies
- Highly secure – same security as the Internet
- Off-the-shelf tools are available

- Network = 1 physical connection to the EGM
- Network = Each EGM can talk to lots of hosts
- Six Host connections should be the minimum
The Benefits of a Standard

- Standard protocol enables off-the-shelf development tools and discussion forums
- Allows for extensive testing
  - Protocol Simulators – basic communications
  - Test Tools – Test the “Edge” conditions
  - Load Testers – Explore a system’s limits
  - Protocol Analyzer – The “Lie Detector”
- Independent Technology experts (RadBlue, GSA, Labs) – anyone can ask any question
The Benefits of G2S

Change = chaos
Is it worth it?
Lots of Change is Happening

- EGMs are being upgraded to handle G2S
  - High speed web-based communications
  - Lots of content moving to/from the EGM
  - Player peripherals move to the EGM
  - Rewriting 20 year old protocol stacks
  - Thinking of new features to make this compelling

- Systems are also being updated
  - Though less benefit to a Systems Manufacturer
Avoiding Chaos...

- G2S Protocol Spec contains lots of details
  - Message Layouts (plus schema)
  - Data model updates / Event Descriptions

- G2S Technical Committee is still active

- Develop against a Reference Implementation
  - SAS differences result from varied interpretations

- Large development/test teams (vs. SAS)
Avoiding Chaos...

- **XML Validation**
  - The schema defines G2S
  - Validation compares the G2S message against the schema to ensure it is “well-formed” and valid

- **Message validation**
  - Descriptive tags must be correctly spelled
  - Messages must be correctly formed
  - Data must be valid as per the rules of the schema
    - Enumeration Lists (list of possible choices)
    - Data Formats (Date value must match a pattern)
Standard Tools and Techniques

- G2S is built on standards, so there are lots of libraries available
  - SOAP, SSL, XML Parsers, etc.

- Standard Tools are available to anyone
  - It’s nice to have someone to talk to…
  - Result in testing during development
  - All messages are **validated** against the G2S schema

- Tools ramp up in complexity as the product matures
The Biggest Benefit

Internet to every EGM

- A world of possibilities opens up
- Take advantage of rich Internet tool-set
- First Apps are like e-mail on the Internet
- Start with Config and Download, but then…
Anyone Can Connect to the EGM

- Direct access to EGM means no reliance on middleware
- Regulators can have their own independent server
- To add functionality, just add another application

Each EGM talks to MANY Servers over 1 physical network connection
No Traffic Jams...

Network Backbone = 1-10 Billion bps

100 Million bps (initial floor communication speed)

8 Million bps (Hi speed DSL)

19 thousand bps (current floors (SAS))
Securing the New Environment

Control in this new world...
Network Security

- Internet technology = robust internet security
- G2S uses off-the-shelf Internet solutions
- SSL/TLS – Prevents eavesdropping, tampering
  - Only those with valid certificates can talk
  - SCEP – automatic certificate issuance protocol
  - OCSP – automatic publishing of revocation lists
- Managed networks (IPSec, etc.) are also fine
- Each EGM has list of registered Hosts
Real-time Program Protection

- GAT = Game Authentication Terminal class
  - G2S – Used to validate software packages on EGM
  - S2S – Used to validate packages on servers

- EGM’s GAT Functions are consistent in all cases:
Real-time Program Protection

- Now – 10% of EGMs are checked each year
- With G2S GAT, software can be validated daily
- Supports CRC, MD5, and SHA signatures
  - *(Whatever is supported by the EGM)*
- With S2S – Verify packages on servers
- EGM signature = Server signature = Program signature from lab
Occasionally, things aren’t quite right between EGM and SMIB

With SAS – use a laptop running serial test
- Requires access to EGM base for EGM to SMIB link
- Must understand the Hex characters that are SAS

With G2S, can use Protocol Analyzer (RPA)
- Can be located anywhere on the network
- Information is easy to understand
- All messages are validated against the schema
Today’s EGM Protocol (SAS)

| HOST   | 82512218.8 | 01 6F 08 00 00 00 00 01 00 02 00 42 55 |
| HOST   | 82512259.6 | 31 General Poll |
| HOST   | 82512267.5 | 80 RESYNC |
| HOST   | 82512267.5 | 01 6F 08 00 00 00 00 01 00 02 00 42 55 |
| HOST   | 82512808.1 | 31 General Poll |
| HOST   | 82512810.1 | 1F |
| HOST   | 82513315.1 | 80 RESYNC |
| HOST   | 82513315.1 | 01 6F 08 00 00 00 00 01 00 02 00 42 55 |
| EGM    | 82512239.1 | 01 6F 17 00 00 00 04 00 00 26 80 01 00 04 00 00 00 90 02 00 04 00 00 00 00 0C 9A |
| EGM    | 82512787.6 | 01 6F 17 00 00 00 04 00 00 26 80 01 00 04 00 00 00 90 02 00 04 00 00 00 00 0C 9A |
| EGM    | 82513334.7 | 01 6F 17 00 00 00 04 00 00 26 80 01 00 04 00 00 00 90 02 00 04 00 00 00 00 0C 9A |

[Looks like hex to me...]
# A G2S Meter Request

## Host Request

```xml
<getMeterInfo>
  <getDeviceMeters
    deviceClass = "G2S_noteAcceptor"
    deviceId = "1" />
</getMeterInfo>
```

## EGM Response

```xml
<getMeterInfo
  meterSubType = "G2S_onDemand"
  meterDateTime = "2008-03-07T15:20:27" >
  <deviceMeters
    deviceClass = "G2S_noteAcceptor"
    deviceId = "1" />
  <simpleMeter
    meterName = "G2S_currencyInAmt"
    meterValue = "14000000" />
  <simpleMeter
    meterName = "G2S_currencyInCnt"
    meterValue = "14" />
  <simpleMeter
    meterName = "G2S_currencyToDropAmt"
    meterValue = "14000000" />
  <simpleMeter
    meterName = "G2S_currencyToDropCnt"
    meterValue = "14" />
  <simpleMeter
    meterName = "G2S_dropDoorOpenCnt"
    meterValue = "2" />
</getMeterInfo>
```

[A little easier to understand]
Forensic Analysis – RPA

G2S Protocol Analyzer

- Received Messages: 306
- Forwarded Messages: 306
- Time to ACK: 18/ 88/ 698/ 42

Error

- cabinet.getCabinetStatus
  2010-08-23T17:20:39.799-07:00
  There are 2 errors reported

- noteAcceptor.getNoteAcceptorStatus
  2010-08-23T17:21:10.856-07:00
  Attribute 'g2s.timeLive' is not allowed to appear i...

- noteAcceptor.getNoteAcceptorStatus
  2010-08-23T17:21:23.938-07:00
  There are 2 errors reported
Forensic Analysis – RPA

Error Browser

Request Errors: <NotSet>
Request Summary: cabinet.get Cabinet Status
Request XML: View XML
Response Comment: 
Response Errors: <NotSet>
Response Summary: G2SACK.error

XML Payload

Text View

0001 <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
0002 <g2s:g2sMessage xmlns:g2s="http://www.gamingstandards.com/g2s/schemas/v1.0.3">
0003  <g2s:g2sBody g2s:dateTimeSent="2010-08-23T17:20:33.782-07:00" g2s:egmId="RBG_1234" g2s:hostId="1">
0004   <g2s:cabinet g2s:commandId="151" g2s:dateTime="2010-08-23T17:20:33.615-07:00"
0005     g2s:deviceId="526059076"
0006     g2s:errorCode="G2SNone"
0007     g2s:errorMsg=""
0008     g2s:sessionMore="false"
0009     g2s:sessionRetry="false"
0010     g2s:sessionType="G2S_request"
0011     g2s:timeToLive="30000"/>
0012   </g2s:cabinet>
0013 </g2s:g2sBody>
0014 </g2s:g2sMessage>
The Road to Aria

A case study of a successful G2S deployment
Overview

- Aria – first G2S casino
  - Opened in December 2009

- Success through collaboration
  - System Vendor and Operator first
  - RadBlue vets extensions and implements in Sims
  - EGM Developers implement G2S and extensions
  - Regulators, Test Labs to make sure all is ok
The Planning Game

- System Vendor and Operator agree on G2S
- NVGCB Lab is brought in early
- Operator and System Vendor decide on needed extensions for Aria
- IGT designs the extensions and schema
- RadBlue tests the extensions
  - IGT Extensions are added to the RadBlue Sims
Building the Solution

- System Development Begins
- Jan 2008 – Kick-off meetings
  - Sims with extensions are available to all parties
  - Standard Reference Implementation
- Labs start to prepare
  - Gaining knowledge
  - Assigning appropriate resources
- GLI gears up to review implementations
  - Independent testing experts
Testing the Solution

- Internal testing ramps up – all developers
- IGT opens GTIC in early 2009
- Those who were most serious about testing show up early and are most successful
- NVGCB discovers that GLI tested apps have least defects
IGT – alpha site for our Load Tester
  ◦ Goal was 2500 events per second
  ◦ 2500 EGMs being played flat out for days on end

Load Tester allowed sbX team to test with a whole floor of EGMs

Load Balancer issues uncovered

RLT – also used to validate the Aria network
Field Trial at Monte Carlo

- NVGCB insists on a field trial
  - Wring out new apps in a live environment

- EGM had to pass NVGCB review before joining the field trial

- Field Trial uncovered new issues
  - Only found after days of public play
  - Fortunately, before the Aria go-live
Aria Opening

- Aria opening was a great success
- Not too many “new” features
  - Just made sure the basics were exactly right
- Review of the new system environment
  - Nothing new
  - “somewhat boring”
- The first G2S floor – worked!
Soon: G2S in Your Casino

- G2S has had its debut
  - Now spreading around the world
  - Casinos and Lotteries

- Can start as small as one bank
- Spread across the floor as appropriate

- A “fearless” G2S install is coming soon to a casino near you…
New Protocols are Widely Accepted

EGM and System Developers
- Ainsworth Gaming
- Aristocrat Technologies
- Aruze Gaming
- Atronic
- Austrian Gaming Industries GmbH
- Bally Technologies
- International Game Technology (IGT)
- Intralot S.A.
- Konami Gaming
- Multimedia Games, Inc.
- Scientific Games International
- Shuffle Master Australasia
- SPIELO, a GTECH Company
- Techlink Entertainment
- Video Gaming Technologies, Inc. (VGT)
- WMS Gaming

Kiosks, G2S engines, and others
- Ameranth
- EDC ATM
- Global Cash Access
- Hermes SoftLab
- New Wave Automation
- Tech Results
- Videobet

Educational Groups
- Gaming Standards Association (GSA)
- GSA University
- Macau Polytechnic Institute

Testing Agencies
- BMM Compliance
- eclipse Compliance Testing
- Gaming Laboratories International (GLI)
- Missouri Gaming Commission
- Nevada Gaming Control Board

Operators
- British Columbia Lottery Corp.
- Isle of Capri Casinos
- Kerzner International
More information

GSA Resources (gamingstandards.com)
- Standards can be downloaded by anyone

RadBlue Resources
- Student Versions of our Sims (EGM, Host, RPA)
- Networked Gaming Resource Page @ radblue.com
- G2S Engine – roll your own application

Russ Ristine (russ@radblue.com)